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Monthly Message

Joint Committee on Aviation Pathology

At the instigation of Group Captain Bruce Harvey, RAF (formerly British Military Mission, USA), a Joint Committee on Aviation Pathology was formally established by the Secretary of Defense, November 1955, with cognizance by the Department of State, and by the Foreign Offices and Defence Ministeries of the United Kingdom and Canada. A permanent secretariat was established at the Armed Forces Institute of Pathology and since then there have been business and scientific meetings. Two of the latter have been held in this country and one in Great Britain.

The purpose of this Committee, in which the 3 countries have all been active participants, has been to accumulate human data from aviation accidents; to offer assistance to our civilian medical examiners and coroners and instruction on the importance of autopsies following fatal accidents and on the proper collection of tissues for chemical analysis for toxic substances; and to offer assistance and cooperation to both civilian and military aviation, particularly with the human factors teams, whose interests lie mainly in the fields of engineering, both human and mechanical.

The chairmanship of the Committee rotates.

The Armed Forces Institute of Pathology is repository for material and records. The first executive secretary was Dr. F. K. Mostofi, a native Iranian, now an American citizen, who contributed greatly to the successful launching and establishment of the Committee during its first 2 years. The Committee assists civilian groups in our major civilian commercial airline accidents and offers its services freely at all times, to both the military and the civilian.

With the establishment of the new Federal Aviation Administration still closer ties will exist. The Royal Air Force has been most enthusiastic, and has provided a steady flow of informational data, and the Royal Canadian Air Force, though much smaller, is equally enthusiastic in support of the Committee. I believe all 3 nations regard this Committee as a major step forward in aviation medicine, and we hope that through the findings and contributions from time to time, flying will become safer for all concerned. As we enter the commercial jet transport phase this becomes of increasing importance to everyone who flies.

Frank B. Berry

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Assistant Secretary of Defense
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Foreword

The *United States Armed Forces Medical Journal* is a monthly publication of professional and administrative information for medical personnel of the Department of Defense. The Assistant Secretary of Defense (Health and Medical) and the Surgeons General of the United States Army, Navy, and Air Force invite members of the regular and reserve medical services, the professional consultants of the military departments, and other physicians and health scientists with an interest in Department of Defense activities to submit manuscripts for publication in this *Journal*.

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UNITED STATES
Armed Forces Medical Journal

Evolution of Pediatric Service in the U.S. Army

COLONEL LEO J. GEPPERT, MC, USA

PRIOR TO WORLD WAR II, pediatrics constituted an infinitesimal portion of Army medical practice, because the Army was small and composed chiefly of unmarried soldiers. During the period between 1920 and 1940 there were rarely more than a dozen deliveries a month at either Walter Reed Army Hospital, which had a total of 178 deliveries in 1938, or Brooke Army Hospital, and the Army Medical Service had no organized pediatric department. Prior to 1940 many Regular Army medical officers experienced minimal exposure to pediatrics during their Army internship, and therefore had difficulty adjusting to postwar Army medical practice.

Dependent care, which prior to World War II was a minor function of the medical department, is now a major task.[1] Medicare has an outlay of $70,000,000 a year; and the problem of dependent care in military hospitals, which have 50 percent of hospital patients and millions of outpatients, is a momentous one. By 31 January 1957, the military forces of the United States were responsible for as many dependents, 2,856,159, as active-duty personnel.[2] In spite of the failure to realize the magnitude of the post World War II demand for dependent medical care, the task of providing such care was assumed patiently, if not enthusiastically. The number of live births in military hospitals increased slowly to 93,108 by 1951 and then skyrocketed to a peak of 172,863 in 1956. It became obvious that the medical services had still not assumed the entire load since the total number of deliveries, augmented by Medicare, reached 248,785 in 1957.[2] With an estimated 4,301,000 births in the United States in 1957,[3] 5.8 percent of all births in the United States were Armed Forces dependents. However, the medical services have no reason to apologize for the way in which this care was provided from 1946 until 1956, when Public Law No. 569 provided some respite through Medicare.

From Brooke Army Hospital, Fort Sam Houston, Texas.

Fortunately, dependents eligible for care in military installations did not descend on Army hospitals en masse, and the task could be assumed at the graduated pace reflected in table 1. Reasons for this delay are not entirely clear, but numerous factors were responsible: the time required for families to reassemble in the vicinity of Army installations after the war; the shortage of housing around military installations; and an increasing tendency to marry and have children earlier, partly because of faster promotion and more economic stability.

Obviously, dependent care could not be used before it was provided. Prior to 1949 dependent care was optional with hospital commanders, varied with the facilities available and was not provided by many Army hospitals. In 1947 the Army had less than a half-dozen qualified pediatricians and obstetricians, but as a result of the residency training program, the number increased in proportion to the load, or the load increased proportionate to the care provided, until by 1958, 29 regular Army medical officers were certified or qualified in pediatrics, and 47 in obstetrics. In the interim, most patient care was provided by civilian physicians completing their obligatory 2 years of service.

Table 1. ***Increase in numbers of live births and of certified pediatricians and obstetricians, U.S. Army, 1947–57****

Year	*Mean strength† U.S. Army*	*Live births††*		*Certified* pediatricians*	*Certified* obstetricians*
		U.S. Army	*WRAH and BAH*		
1947	1,019,794	24,865**	2,010	2	1
1948	947,648	38,475**	2,588	4	1
1949	869,028	37,110**	3,238	4	3
1950	703,934	33,402	3,612	4	5
1951	1,462,394	45,337	3,897	7	6
1952	1,603,711	59,830	4,441	14	9
1953	1,532,905	66,516	4,525	18	9
1954	1,425,919	74,070	4,283	16	13
1955	1,193,337	77,478	4,142	15	14
1956	1,034,936	80,619	3,973	16	17
1957	986,504	63,808	3,598	18	16

†Statistical Health Report (WD AGO Form 8-122) and the Morbidity Report (DD Form 442).

††1947–51—Tabulations of Individual Medical Records; 1952–57—Beds and Patients Report (DD Form 443).

*Regular Army only. Information by courtesy of Lt. Col. Dan Crozier, Medical Consultant Division, SGO.

**Includes live births at U.S. Air Force facilities through the first half of 1949.

BAH = Brooke Army Hospital, Fort Sam Houston, Tex.

WRAH = Walter Reed Army Hospital, Washington, D.C.

During this period, maternal mortality was 3 per 10,000 live births, less than half the death rate of the general population. With maternal mortality so low, survival of the baby has become the primary concern of the obstetrician.[4] Since 1947, late fetal mortality (stillbirths) and neonatal mortality in military service hospitals have been appreciably lower than the rates for the United States as a whole. At Brooke Army Hospital and Walter Reed Army Hospital late fetal mortality per 40,307 live births was 1.4 percent, compared to 1.9 percent in the general population; neonatal mortality was 1.7 percent compared to 2 percent for the general population; and perinatal mortality was 3 percent compared to the national average of 3.9 percent for the 10 years following 1947. These rates compare favorably with those of other teaching hospitals.[5] Perinatal mortality in 1952 increased from 2.92 percent to 3.59 percent with a one-third increase in the number of deliveries in that year, no doubt because existing facilities were overloaded. The figure dropped to 2.84 percent as procedures were developed to handle the increasing load, and to 2.5 percent, with a 20 percent decrease in the number of deliveries, when Medicare became effective. Perinatal mortality for 16,084 deliveries was 2.4 percent in the European theater in 1958.[6]

Prior to World War II, the Army medical service had no pediatric facilities as such. There were a number of medical officers, such as the late Major General George C. Beach, MC, USA, whose empathy with children and parents gave him a large practice of devoted admirers; but usually, Army families found outpatient care where they could, requesting hospitalization from the Medical Corps chiefly for expensive orthopedic or surgical care. Children were admitted wherever suitable space could be found, usually on the women's ward. During World War II most Army hospitals made no attempt to furnish dependent care; but permanent installations, which had always provided some care, tried to maintain it. The first pediatric ward was opened by Dr. J. B. Snow at Brooke Army Hospital in 1943, and 161 patients were admitted the first year.

The first Army pediatric service was officially organized at Brooke Army Hospital by the author. Temporarily approved for residency training in 1947, it was fully approved in 1949. The number of outpatients treated that year reached 16,000, with almost 1,200 hospital admissions. The pediatric service at Walter Reed was organized in March 1949, under the direction of Colonel Ogden C. Bruton. In its first year of operation, 12,000 outpatients were seen and 371 patients admitted. The rapid expansion of these services to keep up with the demand is shown in table 2. In less than 10 years, they have doubled in size. Shortly after the pediatric service

at Walter Reed was established, pediatric services were organized at Letterman Army Hospital by Lieutenant Colonel Walton Edwards and at Fitzsimons Army Hospital by Major William Currence. They followed patterns of growth similar to those at Walter Reed and Brooke. Residency programs have since been established at Tripler, William Beaumont and Madigan Army Hospitals. Major services are operated at almost every large post in the Far East and in Europe, in addition to those in the United States.

With deliveries of dependents of uniformed personnel running at an annual rate of over 200 thousand, the medical services would expect to have between 3 and 4 million dependent children; but fortunately,

Table 2. ***Expansion of pediatric care at Brooke and Walter Reed Army Hospitals, 1946–58****

Year	*Outpatients*		*Immunizations and injections*	*Inpatients***		*Deaths*	
	BAH	*WRAH*	*BAH*	*BAH*	*WRAH*	*BAH*	*WRAH*
1946	13,393	–	7,473	564	–	13	–
1947	11,466	–	8,048	1,017	–	18	–
1948	13,719	–	7,991	1,003	–	23	–
1949	16,735	12,000	17,581	1,192	371	32	22
1950	16,463	17,365	17,885	1,200	533	25	31
1951	17,929	29,777	15,026	1,237	1,219	38	25
1952	19,808	27,000	21,697	1,274	1,244	36	29
1953	18,969	26,571	18,469	1,260	1,200	47	18
1954	23,555	27,708	16,935	1,345	1,194	49	38
1955	27,522	35,600	17,883	1,291	1,447	38	42
1956	29,010	32,600	32,636***	1,371	1,234	29	54
1957	37,918	29,782	41,051	1,667	1,629	25	41
1958	36,837	–	48,496	2,105	1,588	35	–

*Progress Reports and Statistics, Office of Secretary of Defense, 3 July 1957.
**Children under 14; medical and surgical.
***Availability of poliomyelitis vaccine doubled the number of injections.
BAH = Brooke Army Hospital, Fort Sam Houston, Tex.
WRAH = Walter Reed Army Hospital, Washington, D.C.

because of the age group in military service, this is not the case. Many young people marry and have their first child while in the military service but leave after the period of compulsory duty. Because of this, in 1956 the military services actually had only 1,632,696 children eligible for care by military facilities. Pediatric admissions to general hospitals appear to be leveling off, partly because of Medicare, but chiefly because there are fewer referrals from the better equipped and staffed station hospitals—a result of the residency program. Actually, Medicare seems to have increased the demand for dependent care in many fields because it made optional services mandatory and provided a firmer legal basis for dependent care. Also,

for the first time many Army people discovered the care to which they were entitled.

The number of outpatients can be expected to continue increasing by geometric proportions, since Medicare cannot provide for outpatient visits. Fortunately, outpatient care is relatively inexpensive. A problem peculiar to pediatrics, however, is that telephone calls outnumber all visits; the average pediatrician, even in the Army, spends 4 hours a day on the telephone, much of it at home after hours.

Unlike specialties that confine themselves to a single organ system, pediatrics is a specialty because of the unique problems presented by the growth and development of the child. The child is not a small adult, and his physiology changes completely at various ages. The age limit for childhood is customarily set at 14, and children of both sexes are commonly kept on the same ward, with adolescence being the limiting factor. A girl of 11 who has reached the menarche belongs on the women's medical ward rather than a pediatric ward. If pediatrics were not already a medical specialty, it would be necessary to make it one for the benefit of the nursing service. Requirements for diapers, formulas, and other care make it much more efficient to group all children by age, regardless of their type of disorder.

Pediatric wards present unusual administrative problems to a military service accustomed to basing personnel requirements on number of beds and on beds occupied. The average children's hospital in the United States has about 100 beds; in military medicine this is indeed a small hospital. The average hospital stay is only 7 days, however, and a tremendous number of patients can be handled annually with a small number of beds.

Personnel requirements, especially nursing service, record processing, and stenographic help, are all related to the number of admissions rather than to the number of beds. A short hospital admission is a great deal more expensive in terms of dollars per day than a long hospital admission. Almost all children are bed patients, and it is not unusual to have half the patients on a pediatric ward on the critically ill list. Since the child is anxious to go home and his parents press for his release, even postsurgical patients are discharged as soon as the critical period is passed. The 5 percent mortality figure common to children's hospitals reflects the seriousness of the average hospital admission. One pediatric ward at Walter Reed with 23 beds (2 percent of total beds) admitted 900 patients in 1 year, 7.5 percent of total admissions and 10 percent of total deaths. Pediatrics and obstetrics combined require almost one third of the hospital's nursing staff—a demand that can be met in larger hospitals, but that is almost

impossible in smaller station hospitals. In these installations it is often necessary to admit the mother with the child to provide nursing care. The personnel requirements for a pediatric ward are 1 nurse or nurse substitute per patient per 24 hours.

Handling records presents a similar problem because the child may be discharged before reports of roentgenograms, operations, or pathologic examinations have reached the ward. Since data essential for patient care are obtained almost entirely by telephone or other personal communication, extra time is required of all hospital personnel. The patient's chart can therefore not be closed satisfactorily at the time of discharge, and the time lag before its final closure may seem outrageous to administrative personnel accustomed to dealing with soldier patients, who are not discharged until able to return to duty.

Fortunately, pediatrics requires little special equipment and is not expensive from the standpoint of special supplies. It does present special problems such as diaper service and formula preparation. Introduction of polio vaccine in 1956 doubled the demand for immunizations. The outpatient pediatric service presents a major expenditure to the pharmacy since pediatric formulations account for about 20 percent of all prescriptions.

Since the introduction of antibiotics, medical admissions in pediatrics are decreasing rapidly and children's hospitals are becoming progressively more surgical. At least 50 percent of pediatric patients admitted to military hospitals are now surgical. However, in children under 2 and in older children undergoing major surgical procedures, surgery is still considered incidental and the patient is admitted to a medical ward, where maximum nursing and medical support can be administered.

The composition of pediatric practice has been described in a previous paper by the author.[7] The type of pediatric hospital patient is related directly to the number of referrals (table 3). Thus, in Tokyo Army Hospital, where the number of satellite institutions from which patients were referred was small, infection accounted for the majority of hospital admissions. Walter Reed, where the patients are mainly referrals, is at the other end of the scale. The number of malignancies and congenital anomalies admitted at this hospital exceeds all statistical probability, and these difficult patients become the main problem. From a topographic viewpoint the increase is chiefly in cardiovascular and neurosurgical problems. A direct relationship between personnel requirements and the number of referrals to a given hospital is obvious, since these patients require maximum medical, surgical, and especially nursing care.

Table 3. ***The effect of numbers of referrals upon the etiologic and topographic distribution of diseases in the pediatric services of 3 large Army hospitals***

DISEASE ACCORDING TO ETIOLOGY	*Tokyo AH 1950–55*		*BAH 1946–55*		*WRAH 1955–57*	
	percent of 5,000 admissions	*percent of 30 deaths*	*percent of 9,000 admissions*	*percent of 202 deaths*	*percent of 2,279 admissions*	*percent of 144 deaths*
Lower plant or animal parasite	62.6	23.4	55.6	35.1	13.0	11.1
Prenatal influence	12.4	53.1	14.3	28.0	43.0	55.6
Trauma or physical agent	5.6	10.0	10.0	7.0	9.0	9.0
New growths	1.3	3.5	2.0	21.5	10.0	21.5
Intoxication	2.6	----------	4.7	1.5	4.2	----------
Disorder of metabolism, growth, or nutrition	2.1	----------	4.1	4.0	4.1	1.4
Higher plant or animal parasite	1.3	----------	1.8	2.5	0.6	----------
Disturbance of innervation or of psychic control	0.6	----------	3.4	----------	2.5	----------
Unknown or uncertain cause with structural reaction	4.0	5.0	2.4	0.2	4.2	0.7
Unknown or uncertain cause with functional reaction	7.5	5.0	1.7	0.2	9.4	0.7
DISEASE ACCORDING TO SITE						
Respiratory system			24.9		9.8	
Digestive system			17.6		18.5	
Body as a whole			13.5		8.2	
Integumentary system			8.4		4.4	
Organs of special sense			7.7		6.3	
Musculoskeletal system			7.4		6.4	
Nervous system			7.1		10.6*	
Urogenital system			4.2		6.3	
Hemic and lymphatic systems			3.6		6.3	
Unknown			3.2		3.8	
Cardiovascular system			1.5		17.6*	
Endocrine system			0.9		1.8	

*Referrals especially increase these 2 categories of admissions because specialized technics are required.
BAH = Brooke Army Hospital, Fort Sam Houston, Tex.
WRAH = Walter Reed Army Hospital, Washington, D.C.

In the military service pediatrics unfortunately had to face a double struggle for recognition. Personnel assignments of pediatricians during World War II were notoriously poor, probably because no one was exactly sure what to do with pediatricians. This was to some extent the fault of civilian pediatric organizations, which, unlike similar groups in other specialties, made no attempt to assist the military service in utilizing their personnel properly. The classification of communicable disease specialist was used until the demand was filled. Fortunately, physicians outstanding in pediatric research were picked up by the preventive medicine section and were well utilized.

Because the Army had no pediatric service before the war and because many ex-service civilian pediatricians were bitter toward the military service, it was extremely difficult to convince the proper civilian authorities that the Army could develop accredited pediatric services. Civilian institutions could easily have trained the number of pediatricians the Army required, but pediatric departments were needed for training surgeons, orthopedists, psychiatrists, and other specialists. The appointment of a number of civilian consultants to military hospitals and a chief consultant in pediatrics to the Army Surgeon General from Army personnel has greatly enhanced Army-civilian relationships.

CONCLUSION

Data included in this paper indicate that although the task of providing dependent care was assumed without the preliminary planning for which the Army is famous, it has been accomplished with exemplary results. This is especially true from the standpoint of providing the greatest care for those whose need has been greatest. It is emphasized that dependent care is now a major task of the medical department, and that even with the tremendous annual outlay for Medicare, military service hospitals must still care for 50 percent of hospitalized dependents and millions of outpatients.

REFERENCES

1. Wergeland, F. L.: Medicare program: progress, problems, principles. *Mil. Med.* 124: 23–29, Jan. 1959.
2. U.S. Army Office for Dependents' Medical Care: Dependents' Medical Care Program, First Annual Report. 1 June 1958, p. 65.
3. Monthly Vital Statistics Report. National Office of Vital Statistics, Vol. 6, No. 13, part 1, April 9, 1958, p. 2.
4. Simpson, J. W. and Geppert, L. J.: Responsibility of obstetrician to the fetus; analysis of fetal and neonatal mortality in 10,000 deliveries. *Am. J. Obst. & Gynec.* 62: 1062–1070, Nov. 1951.
5. Yankauer, A. and Alloway, N. C.: An analysis of hospital neonatal mortality rates in New York State. *A. M. A. J. Dis. of Child.* 95: 240–244, Mar. 1958.
6. Maternal Statistical Data, Annex A to the Essential Technical and Medical Data Report. USAREUR, 1958.
7. Geppert, L. J.: Composition of pediatric practice at permanent Army base in antibiotic era. *Pediatrics* 22: 336–363, Aug. 1958.

Multiple Sodium Iodide Crystal Arrays for Total Body Counting

COMMANDER HARRY J. WATTERS, USN

IN THE PAST FEW YEARS there has been an increasing interest in the subject of large-volume, low-level counting. As far as the general public is concerned, the interest and awareness regarding this very specialized procedure can be attributed to some excellent publicity describing the work performed by the Los Alamos and the Argonne Laboratory groups. Within the medical and scientific community, however, this increasing interest stems from additional motivations. Compliance with the Recommendations of the International Convention on Radiological Protection, for example, concerning maximum permissible concentrations and exposure levels will necessitate the monitoring of personnel, foodstuffs, materials, and even working areas at levels which are comparable to, or even below, existing natural backgrounds. There is also an urgent need to obtain a statistically meaningful history of the total body burden of the general population, and to be capable of detecting small changes in this all important parameter.

In the letter of invitation to this symposium, it was pointed out that the Navy's interest in this subject stems from an interest in the methods of determining radiation exposure from peacetime accidents, and that the increasing use of nuclear propulsion in Navy vessels produces an increase in the number of personnel potentially exposed. I should like to make a few general remarks concerning low-level counting, and then discuss a few specialized applications of these technics. This somewhat qualitative approach to the problem will, hopefully, be of some assistance to those of you contemplating installation of a facility for low-level, total body counting.

The basic objective, in any low-level counting procedure, is the achievement of some predetermined statistical precision in a limited

From the Office of the Special Assistant to the President for Science and Technology, Washington, D.C. Presented on 9 May 1959 in a symposium, "The Acute Radiation Syndrome," at the U.S. Naval Medical School, Bethesda, Maryland.

period of time. Please note that I used the term limited time, not minimum time. (A related problem, of course, is that of assuring the long-term stability of the instrumentation involved in order to eliminate the introduction of other errors that could exceed these statistical uncertainties.) In this sense, low-level measurements can be defined as those performed to identify amounts of radioactivity so small that the degree of precision achievable is limited only by statistical counting errors. Achievement of this basic objective necessitates, among other things, the use of construction materials relatively free of radioactive contamination, some effective method of shielding against natural background, and other procedures with which most of you are familiar.

With this brief general introduction, I should now like to consider the specific subject of the application of low-level counting technics to the problem of determining the total body burden by external measurements of electromagnetic radiation. First of all, in my opinion there is no such thing as an all-purpose, total-body counter. I sincerely hope that when I have finished, at least some of you will agree with this statement.

The large-volume, liquid scintillation systems are extremely valuable in certain specific applications. One basic reason for their utility derives from the fact that, per unit mass, organic scintillators (i.e., the plastics and the liquids) are considerably cheaper than are heavy scintillators such as NaI. The integrated cross section for the Compton interaction (which is essentially the only interaction producing scintillations in organic detectors) is approximately the same in equal masses of either NaI or organic scintillator. Therefore, for fewer dollars you can obtain a greater number of Compton-produced scintillations in organic materials than in NaI, merely because these same dollars will purchase a greater mass of organic scintillator. However simply to produce these scintillations is not enough; one must also observe them. Since the density of organic scintillators is relatively low, the volume represented by a given mass is several times that of an equal mass of NaI. Therefore, in order to observe this large volume of organic material effectively, additional dollars must be spent for photocathode surface. The total photocathode surface used in a large-volume, organic scintillation detector is not trivial, nor is the dollar investment it represents. The 4-pi liquid scintillation counter now under construction at the Los Alamos Laboratory, for example, will use 24 photomultiplier tubes each 16 inches in diameter. These components are not particularly inexpensive, and, the wide variation in photosensitivity over the face of these large tubes can be particularly troublesome. In addition, many

applications will necessitate the use of massive shielding against natural background, the installation of which, for such large volumes of scintillating material, is expensive.

Nevertheless, in those very special cases where (1) speed in sample processing is paramount, (2) the identity of the gamma emitters present in the sample is already known, and (3) energy resolution better than about 50 percent is not required, the large-volume, organic scintillation systems may have valuable application.

One point concerning energy resolution should be clarified. In scintillation spectroscopy, the "energy resolution" of a system is usually defined as the "full width at half maximum of the cesium ^{137} photopeak." In terms of this definition, typical values of energy resolution obtained with NaI crystals and small-sized phototubes vary from 8 percent to 11 percent. With large-sized phototubes, i.e., 8-inch diameter and larger, it is not uncommon to obtain values as high as 15 percent. In terms of the full width at half maximum of the cesium ^{137} peak, the energy resolution of the Los Alamos 2-pi "walk-in" liquid scintillation counter would be something in excess of 50 percent. (It should be noted that the "peak" referred to in organic scintillation systems is the rather broad, asymmetric Compton peak, and not the nearly gaussian photo peak observed with NaI scintillators.) This 50 percent resolution is to be compared with the 8 percent resolution obtained with detection systems using NaI crystals and 2-inch diameter phototubes. If, on the other hand, we define the resolution of NaI scintillation detectors in terms of the "half width at half maximum of the K ^{40} photopeak," we obtain a value of something less than 3 percent, which is to be compared with the 18 percent resolution specified for the Los Alamos counter.

These special conditions, however, under which large-volume, organic scintillation systems may have valuable application, are restrictive. In many instances, it is desirable to do total body counting of persons whose total body burden differs from the norm in some way. Perhaps such persons have been exposed to an abnormal neutron flux, either long term at low level or short term at high level, and a study of the whole body effects of such an irradiation by some activation technic is of interest. It may be that one wants to conduct simultaneous multiple tracer experiments in order to study localization and transport of gamma emitters within the body. It is also possible that a number of persons may be involved in nonfatal nuclear accidents and one will want to determine the internal body burden resulting from such accidents. These and other situations in which the identity of the gamma emitters present is not certain are the ones I believe to be extremely important, and certainly this is so from the point of

view of the expressed Navy interest in total body counting. In situations such as these, there is no substitute for precise gamma-ray spectroscopy performed on the whole body. Further, I doubt that anyone will seriously question the statement that NaI scintillation detection combined with multichannel pulse height analysis is the best method known today for obtaining these precise gamma-ray spectrums. Certainly no one will suggest that organic scintillators are suitable for such applications.

Having made these dogmatic statements, I should now like to discuss very briefly the relative merit of single and multiple crystal arrays of NaI detectors. I am certain that this idea is not an original one; however, I began harping on it about 2 years ago. My conviction that multiple crystal arrays are superior to a single large crystal for total body counting derives in part from the following considerations:

First, in total body counting, one would like to have a uniform system sensitivity over the whole body, i.e., one would prefer that a given amount of activity, located, for example, in the left foot, produce essentially the same total number of counts as that same amount of activity would produce if it were located in the liver. With a single crystal detector this would require that every point in the body be nearly equidistant from the center of the crystal. Now these old bodies of ours do not conform well to the shape of an arc, and since some are lean and stringy, and others are lumpy and bumpy, this becomes difficult of accomplishment. The tilting chair was designed to approximate this ideal body position within certain limits of comfort, and even this leaves something to be desired.

Second, one wants to limit the counting time required per subject to some sensible value. If counts on a large number of subjects are to be obtained, a counting time of 1 hour per subject is too long. On the other hand, it doesn't make sense to set an arbitrary limit of something like 40 seconds or 3 minutes. After all, if any degree of precision is required, each subject must shower thoroughly, the hair must be well cleaned, and deposits must be removed from under the nails. Eventually each subject must enter the detection system as free of external contamination as possible. This time required for preparation should ultimately determine the minimum acceptable counting time per subject. A figure like 10 or even 15 minutes appears logical.

Even for counting times of this magnitude, a rather large volume of NaI is required to achieve the desired statistical precision. However, this large volume of NaI need not be in the form of a single crystal, but may be made up of several smaller crystals oriented in

some geometric array to produce a reasonably uniform sensitivity over the whole body. One should not infer that this permits the use of a large number of very small crystals. It appears that a crystal 3 inches in diameter by 3 inches thick is about as small as one can go and still achieve a satisfactory peak-to-total efficiency for the range of gamma-ray energies anticipated. At any rate, smaller crystals permit the use of smaller phototubes, which inherently provide better energy resolution.

My third reason for preferring a multiple array is simply this: I believe that in the same period of time required for a precise determination of total body burden, a suitably designed array can provide valuable information concerning the physical distribution of radioactivity within the body.

Until recently, objections to this multiple detector technic were made on the grounds that it would be extremely difficult to adjust the gains of the individual detectors to the same value and, possibly, still more difficult to avoid loss of resolution caused by gain drift in individual detectors. An old friend, Mr. Hugh Stoddart of Baird-Atomic, was able to provide me with one answer to this objection. By evaluating the performance of a large number of scintillation spectrometers coming off the Baird-Atomic production line, he determined that the over-all drift of system gain, from all causes including thermal, was less than ½ of 1 percent in 24 hours. A drift of this order of magnitude would, of course, have a negligible effect on the resolution obtained by adding the outputs of N individual detectors. More recently, one finds that those laboratories using large single crystals for precise gamma-ray spectroscopy are no longer observing these large crystals with a single large phototube. It has been found, in practice, that the energy resolution can be greatly improved by viewing the large single crystal with a multiple array of smaller phototubes. Evidently the problem of gain alinement and drift is not really troublesome at all.

Realizing this, it is but a small step to make the transition to a multiple detector array. At Chalk River, Cowper [1] has done just this. He suspends three 5- by 4-inch crystals, each with its own 3-inch phototube approximately 18 inches above the lap of a subject positioned in a tilting chair. With this system, Cowper obtains an energy resolution of about 11 percent and does not experience any difficulties of gain instability. In fact, I understand that he alines the system only infrequently and that this alinement is simply accomplished by using a cesium source and an oscilloscope.

Figure 1 illustrates the performance that can be expected from a particular multiple crystal detection system. These curves of detec-

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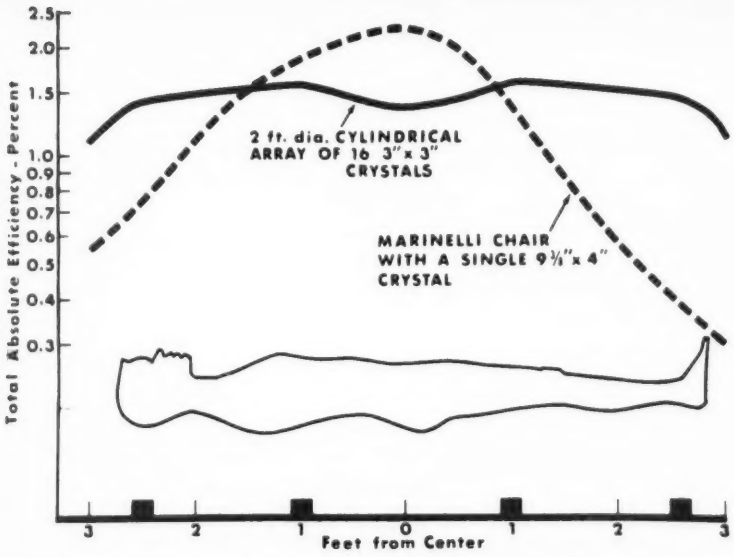

Figure 1. Comparison of efficiency of multiple and single crystal detection systems for assumed line source of 1 mev gamma-ray emitter.

tion efficiency were calculated using the method described by Vegors, Marsden and Heath [2] of the Materials Test Reactor staff at Argonne National Laboratory for an assumed uniform line source of a 1-mev gamma-ray emitter distributed along the longitudinal axis of the body. No corrections were made for absorption or scattering within the body. The solid curve represents the absolute detection efficiency of a cylindric detector array consisting of sixteen 3- by 3-inch NaI crystals, oriented as shown, in 4 rings of 4 crystals each, on a diameter of 26 inches. The dashed curve illustrates the maximum absolute detection efficiency achievable with the largest single crystal I know of in use for this purpose—9⅛ inches in diameter by 4 inches thick. In the latter case, the variation of efficiency over the body was calculated for a system geometry in which the subject is positioned in a tilting chair with the center of the large single crystal located 40 cm above the lap. The conclusion is, I believe, rather obvious. Note that, in contrast to the single crystal, the array provides an efficiency that is reasonably constant throughout the full length of the sensitive volume of the detection system. I might add that, at the assumed gamma-ray energy of 1 mev the peak-to-total ratio for the 3- by 3-inch crystals is approximately 42 percent.

A calculated efficiency curve for the present Argonne National Laboratory system (i.e., an 8- by 4-inch crystal positioned 40 cm above a tilting chair) has essentially the same shape as the dashed curve, with ordinates only about 70 percent as high as those shown here. A numerical integration reveals that the over-all total body counting efficiency of the 16-crystal array is approximately twice that of the Argonne National Laboratory system just described.

From a purely objective viewpoint, one of the most useful properties of a multiple crystal array appears to be that of versatility. Regardless of the primary objective of any given total body counting procedure, it would appear highly desirable to extract the maximum possible from the total amount of information obtainable in a limited counting time. By simple pulse-adding technics, i.e., merely adding the output pulses from each of the 16 detectors in the array, one can obtain the high over-all total body counting efficiency indicated by the solid curve of figure 1. In the same total counting time one can, in addition, obtain valuable information concerning the physical location of radioactivity within the body. For example, by adding the pulses from the 4 detectors in each ring, one may obtain 4 additional pieces of information (1 from each ring) that may prove to be valuable in determining the longitudinal distribution of radioactivity within the body. The numerous other detector combinations possible permit the experimenter to "custom tailor" a high-efficiency, total body counter in order to obtain supplementary information when necessary or desirable.

From the standpoint of simplicity of construction and shielding, an array similar to the one shown is particularly desirable. Picture a situation something like the following: (1) A cylindrical iron shield about 7 feet long, inside diameter 3 feet, having walls some 6 inches thick, is positioned with the axis horizontal in a convenient location. (2) The 16-phototube-crystal detector assemblies project inside the inner wall of the shield by about 4 inches to decrease the scattering effects. (3) The subject to be counted can then be introduced into the sensitive volume on a slide, similar to loading a projectile into the breech of a large gun.

So much for this particular system geometry; and please remember that this is the only present consideration—simple geometry.

There is another multiple detector geometry which appears promising for total body counting applications. Recall, if you will, that the primary objective is to achieve a high statistical precision in a limited period of time. One also desires, with no increase in counting time, a detector sensitivity that is uniform over the whole body and a counting technic that provides information concerning the physical

distribution of radioactivity within the body. As we have just seen, the 16-detector cylindrical array provides such a capability. At the same time, one does not especially like to see the 8 crystals (making up the 2 end rings of the 16-crystal array) contribute so little to the over-all efficiency of the system. Visualize then, if you will, that we have cut off a 2-foot length from the previously described cylindrical shield and that we place this 2-foot section or doughnut with its axis horizontal in any suitable location. Now, let us replace the four 3- by 3-inch crystals in this tetrahedron array with eight 5- by 4-inch crystals, positioned within the shield in such a manner that they form an octahedron array. If we assume that the over-all efficiency is roughly proportional to the total crystal volume, this increases the efficiency (for a source on the axis) by a factor of about 8. With this added factor of 8 in sensitivity, we can now afford to take the time to scan each subject, by slowly drawing though the doughnut shield a rolling platform on which the subject has been properly positioned. If you like, you may visualize the mechanics of such a procedure as similar to those involved in the typical 1-minute carwash production line. Such a system permits us to obtain a really uniform sensitivity over the whole body and to determine precisely the longitudinal distribution of gamma emitters within the body. In addition, by suitably combining additional outputs from the individual detectors of such an array, one can now obtain supplemental information concerning the second and third dimensional coordinates of the in vivo radioactivity.

Up to this point I have been discussing arrays primarily from the viewpoint of geometric considerations and their effect on total body gamma-ray counting efficiency. I should like to make one more point at this time.

It has been stated that, since the principal gamma emitters in man are potassium ^{40} and cesium ^{137}, the cesium ^{137} fraction (determined by total body counting in liquid scintillation systems) can be used as a tracer to study the internal body burden of other fission products. I find this a little hard to believe for 2 reasons:

First, in general, different fission products behave dissimilarily in the ecologic cycle. In addition, the half periods of the principal fission products vary over a wide range. Therefore, the use of 1 fission product as a tracer for the extent of biologic retention of another infers a preknowledge of the precise biologic behavior of these fission products, a preknowledge of the age of the fission product contamination on its introduction into the ecologic cycle, and a preknowledge of the time and the method of introduction into the human body.

Second, due to the poor energy resolution obtained with organic phosphors, I question the ability of such systems to differentiate, for example, between zinc ^{65} and potassium ^{40}, or between iodine ^{131} and cesium ^{137}. Proponents of the organic scintillator detectors will argue that such discrimination can, in fact, be made, and will illustrate this claim with curves that show these peaks clearly resolved. With organic scintillators, these peaks are clearly resolved only when the individual pulse-height spectrums are obtained using individually pure gamma-emitting sources. It is a different situation when one obtains the pulse height spectrum of a mixture of zinc ^{65} and potassium ^{40} or of iodine ^{131} and cesium ^{137} and then attempts to resolve the individual spectrums graphically in this complex spectrum. The situation is even more difficult when large-diameter phototubes are used in the detection system. How does one go about resolving a complex spectrum (resulting wholly from Compton interactions) when it is known that, for a given intensity of incident light, the output pulses from a large-diameter multiplier phototube may vary as much as 40 percent as a result of the combined effects of photocathode nonuniformity and dynode geometry?

We may find, therefore, that we are unhappy with present methods for determining the strontium ^{90} body burden, or that of some other hard beta emitter. In such instances one may want to attempt a procedure that permits their detection, in vivo, by observation of the bremmstrahlung radiation. In such cases, and probably there are others, one does not desire to use the thick NaI crystals. I submit that the geometric and shielding considerations, just described for total body gamma-ray counting, are equally applicable in a procedure such as this. All one needs to do in such a case is replace the thick NaI crystals with thin NaI crystals of the same diameter. The doughnut shield, electronics, and mechanics of the counting procedure are unchanged. In fact, one might consider mounting 2 rings of detectors in a single doughnut shield, 1 ring for total gamma (i.e., thick crystals) and 1 ring for bremmstrahlung and roentgen rays (i.e., thin crystals). As Dr. Miller [3] suggested earlier, one may want to return to proportional counters for the detection of low-energy radiation. The geometric considerations of multiple detector arrays are equally applicable in this case as well.

Perhaps some of these concepts seem a little farfetched at first glance. I sincerely hope that they do because this may provoke a little thought on the subject. My principal purpose in speaking here today will have been accomplished if those of you who are contemplating the installation of a facility for whole body counting will review your actual needs and requirements in the light of the things I have discussed. I

know full well the feeling of disappointment that prevails when one suddenly finds that the tool one has built or purchased is not satisfactory to accomplish the intended purpose.

SUMMARY

After a brief review of the varied objectives of total body gamma-ray counting, this subject is discussed with special reference to the application of multiple NaI crystal arrays. A comparison is made between the total absolute gamma-ray efficiencies of single and multiple crystal detection systems, followed by a discussion of energy resolution and over-all system gain stability. The advantages and disadvantages of multiple detector systems are brought forth, as are questions concerning versatility, cost and over-all space and shielding requirements. The use of multiple NaI crystal detection systems appears to be favored over single large crystals and organic scintillators in all but the most specialized applications.

REFERENCES

1. COWPER, G.: Personal communication.
2. VEGORS, S. H., Jr., MARSDEN, L. L. and HEATH, R. L.: Atomic Energy Commission Report IDO–16370, 1959.
3. MILLER, C. E.: Argonne total body counter. Presented in a symposium, The Acute Radiation Syndrome, at U.S. Naval Medical School, Bethesda, Md., May 9, 1959.

DEATH FROM CANCER

Surgical thought has been widened, deepened, and extended to embrace the concept of cancer as a systemic or biochemical disease, radiating initially from a single focus but later from metastases as well. It is admissible in surgical circles now that both surgery and radiation are frequently inadequate and, of course, cancer chemotherapy is in its infancy. However, above all, our concepts have been developed to the point that cancer is clearly recognized for the metabolic aggressor that it is. The cause of death in the presence of far advanced cancer is an extensive derangement of normal biochemical functions and, in this respect, the similarity between malignant disease and sepsis is once again underscored.—JAMES D. HARDY: Why Do Cancer Patients Die? *Surgery, Gynecology & Obstetrics*, March 1959.

"Back-Door" Digitalis Intoxication

Review and Report of a Case

MAJOR ROBERT H. MOSER, MC, USA

DIGITALIS INTOXICATION has intrigued physiologists and confounded clinicians since the days of Withering.[1-12] Elucidation of the fundamental role of potassium as a digitalis antagonist at the cellular level has added a new dimension to the concept.[13] When digitalis intoxication occurs as the result of acute or chronic potassium depletion during accepted digitalis maintenance, a "back-door" consideration is added.

The myocardial effects of hypokalemia unrelated to digitalis therapy have been well studied.[14-19] Among others, Schwartz, Levine and Relman [20] have demonstrated the lack of quantitative correlation between low serum potassium levels and electrocardiographic effects. Inexplicable lag periods between induction of hypokalemia and electrocardiographic response were noted. Unaccountable variations in S–T and T alteration, ranging from profound S–T depressions with T-wave inversions during slight depletion of serum potassium levels to normal electrocardiograms during moderately severe potassium depletion, were observed. Patients exhibiting significant nitrogen depletion during hydrocortisone treatment demonstrated a closer correlation of the uncorrected potassium and the electrocardiogram. Although these electrical events have been related to potassium gradients across the myocardial cell membrane and to actual intracellular potassium levels, no definite conclusions have been established.

Subjecting dogs to dialysis for periods of 2 hours, Nichopoulos and Hoffman [18] were able to deplete these animals of calculated extracellular potassium. All developed depression of the S–T segment and lowering or inversion of the T waves. There were no changes in QRS or P waves and U waves were not observed. Animals sac-

From Brooke Army Hospital, Fort Sam Houston, Texas. Major Moser is now at the University of Utah College of Medicine, Salt Lake City, Utah.

rificed 90 minutes after completion of dialysis revealed an average 12 percent increase in cardiac (intracellular) potassium over levels in nondialyzed controls. Such evidence suggests that the electrocardiographic effects cannot be ascribed to intramyocardial potassium depletion.

The increased sensitivity of primary hypokalemic states to digitalis is well established. The ability of potassium to suppress arrhythmias [11, 21] and to correct digitalis intoxication [22] is also well known. The relationship between potassium and digitalis at the level of the myocardial cell remains indistinct, although digitalis effects are associated with potassium migration across the cell boundary. Whether digitalis depletes cellular potassium or interferes with active transport of potassium into the cell has not been determined. It is generally agreed, however, that digitalis overdosage causes intracellular potassium depletion,[11] the severity of the reaction being roughly proportional to the extent of the overdosage.

Probably intracellular potassium is not the only factor in digitalis intoxication. Other cations (H, Ca, Na, and Mg), and blood pH bear a significant relationship to potassium levels [23–25] and so ultimately affect myocardial conductivity.

Various forms of digitalis intoxication will be described below.

Digitalis Overdosage with Normal Potassium

Most instances of digitalis toxicity are unrelated to primary potassium effects but are associated with accidental overdosage or well-intended but unrealistic digitalization and maintenance regimens. The proper dose of digitalis is always an individual pharmacologic experiment necessitating constant monitoring of clinical and electrocardiographic alterations. Adherence to prescribed routines unrelated to size or clinical condition of the patient is perhaps the most frequent cause of digitalis intoxication.

Other instances of digitalis intoxication may be related to communication difficulties between physician and patient. The physician must insure that neither his own semantic difficulties nor the patient's lack of attentiveness or comprehension are permitted to interfere with proper instruction in the use of this potentially hazardous drug. Perhaps of equal importance is careful education of patients in the early signs of overdigitalization. The physician himself should recognize early clinical and electrocardiographic signs of digitalis intoxication. Errors such as improper or unclear prescription writing or ineptitude in compounding may occur on rare occasions.

Adequate Digitalis with Potassium Depletion

"Overdigitalization" of the patient on proper maintenance dosage has occurred in several clinical contexts. Common to each has been acute or chronic potassium depletion, subtly induced by disease states or drug administration. The usual story is one of perplexing intoxication developing in the presence of careful digitalis management, occult hypokalemia being discovered later.

Disease induced. Perhaps the oldest form of hypokalemia in which severe effects have been observed is the "dilution" hypokalemia that occurs in the early, vigorous therapy of diabetic acidosis.[26] The combined use of high doses of insulin and potassium-free saline solutions induces hypokalemia by the rapid incorporation of potassium into glycogen depots and by dilution of extracellular potassium levels. A similar phenomenon may be obtained in any mild hypokalemic state in which extracellular fluid restoration is attempted with potassium-free fluids. Certainly diarrhea from any one of many causes may be a factor in hypokalemia.[27–29] Voluminous diarrhea may deplete the extracellular fluid and cause severe water and potassium-rich electrolyte losses.

The stools normally contain moderate amounts of potassium. Infants with diarrhea may lose up to 7 millimols per day (compared to 2 millimols per day in the normal). When this loss is compounded by replacement with potassium-free solution, the dilution may be fatal. Potassium losses are greatest when the watery stools remain in the colon and are quite low when fluids from the small intestine pass rapidly through the large bowel.[29] Ulcerative colitis, regional enteritis, tumor, and the malabsorption states may be associated with significant potassium loss.

The rapidity of the effects of potassium depletion have been dramatized by Relman and Schwartz,[30,31] and by Tauxe, Wakim, and Baggenstoss,[32] who reported tubular vacuolization in as little as 6 days after the start of a severe persistent diarrhea. Starvation,[29,33] anorexia nervosa,[34] dehydration, persistent vomiting in pregnancy [35] or in intestinal obstruction,[27] prolonged nasogastric suction, and gastrointestinal fistulas may all deplete extracellular potassium. Again, replacement with potassium-free solution may exaggerate the syndrome. Hyperadrenalism with overproduction of aldosterone or other cortical hormones may cause hypokalemic alkalosis with sodium and hydrogen retention.[36–38] The hypokalemia of cirrhosis,[33] nephrosis, and congestive heart failure are, in all probability, related to secondary aldosterone production.[37] Increased susceptibility to digitalis in patients with congestive heart failure may be related to hypokalemia [39]

from secondary aldosteronism. Such syndromes as potassium-losing nephropathy and familial periodic paralysis may be manifestations of primary aldosteronism. Grob, Liljestrand and Johns [40] note the greater fall in serum potassium in familial periodic paralysis than in normals following glucose administration. This is an exaggeration of the same mechanism seen in other hypokalemic states.

In any of these clinical situations the administration of digitalis should be undertaken with caution and meticulous monitoring.

Drug induced. Drug-induced hypokalemic states share a position of equal importance with those induced by disease. Indeed, in these situations digitalis intoxication may occur even more insidiously and remain unsuspected for a longer period of time. Diuretic agents [11, 41] have long been associated with digitalis intoxication. Older diuretics were less hazardous than are carbonic anhydrase inhibitors. Occasionally prolonged use of mercurials induced chloride diuresis, overtaxing the normal renal cation resources (NH_3, Na) and requiring reinforcement with potassium from intracellular areas. This could occur following acute diuresis and as a prelude to digitalis intoxication. In older literature this phenomenon was believed to result from "mobilization" of digitalis from edematous areas, but determination of digitalis blood levels in the diuretic state has disproved this concept and incriminated potassium depletion. Ammonium chloride administered as an auxiliary diuretic agent may provide additional chloride while the NH_4 is metabolized to urea. When given in conjunction with mercurials, the potassium loss tends to be aggravated.

Carbonic anhydrase inhibitors present a somewhat different problem. Acetazolamide depresses hydrogen-sodium exchange by interfering with hydrogen transfer from tubular cells.[41, 42] This in turn depresses "bicarbonate reabsorption" and facilitates potassium loss. Large doses of acetazolamide may cause significant potassium loss and precipitate digitalis intoxication.

Chlorothiazide appears to combine the effects of carbonic anhydrase inhibitors and mercurial diuretics.[42] In large doses it is capable of alkalinizing urine and inducing potassium diuresis. In addition, it causes natruresis and chloruresis in the manner of the mercurials.

Digitalis intoxication has been reported following the use of older cation exchange resins, which did not incorporate potassium into the molecule. Extracellular sodium and potassium are exchanged for hydrogen and NH_4 in the gastrointestinal tract and depletion ensues. A similar situation has occurred following the chronic use of laxatives.[43] Chlorpromazine induces significant diuresis during which potassium is lost, and toxicity may be a problem in prolonged hibernation therapy when digitalis is employed concurrently.[44]

Desoxycorticosterone acetate [17, 34] and the glucocorticoids have also been known to induce potassium depletion in the fashion of hyperadrenal disease states. Sodium and hydrogen are retained while potassium and bicarbonate are lost.

Excessive glucose, ingested or given by vein, has been implicated as a precipitating agent in the digitalized patient with a recent myocardial infarct.[45] This probably represents further depression of serum potassium by induced glycogenesis.[28]

The classic area in which induced digitalis intoxication has been studied is hemodialysis.[46–48] In this situation acute depletion of potassium has provoked severe intoxication in the well-digitalized patient with acute renal failure. In addition, the patient in the diuretic phase of acute renal failure may move rapidly from hyperkalemia to hypokalemia.[49] This condition may be exaggerated by infusion of potassium-free glucose solutions. The accelerated glycogenesis depletes serum potassium as in the patient under therapy for diabetic acidosis.

It is not within the scope of this paper to review the electrocardiographic criteria of digitalis intoxication.[7, 11, 13] Digitalis arrhythmia is a great mimicker of other arrhythmias. It may vary from paroxysmal atrial tachycardia with block to frank ventricular tachycardia and may be erroneously attributed to the underlying heart disease.

The following case report illustrates severe "overdigitalization" occurring as the result of rapid but insidious potassium depletion.

CASE REPORT

A 57-year-old white housewife was admitted to this hospital for the first time on 13 February 1958, with a diagnosis of anterior myocardial infarction confirmed by electrocardiogram (fig. 1). Her course was uncomplicated, with adequate response to a regimen of anticoagulant therapy, 0.25 mg of digoxin daily, low fat diet, and bed rest. She maintained clinical and electrocardiographic (fig. 2) stability and was discharged on 14 March 1958 with the anticipation of long-term Dicumarol therapy.

In early May 1958 the patient noticed bright red blood in the stools and a decrease in stool diameter. Physical examination on readmission revealed a pale, anxious, depressed woman, with blood pressure 140/90 mm Hg, and pulse rate 74. The lungs were clear to percussion, with fine inspiratory wheezes posteriorly. The heart was not enlarged to percussion, and the rhythm was regular, with an occasional premature ventricular contraction and a grade 1 diastolic murmur in the fourth left intercostal space. Rectal examination revealed a large, hard, polypoid mass 4 cm proximal to the anal sphincter. There was fresh blood on the examining finger. The remainder of the physical examination was negative.

Admission laboratory data included: hemoglobin 9.4 grams per 100 ml; corrected sedimentation rate 18 mm per hour; hematocrit 34 ml per 100 ml; and normal white blood cell count, differential, and bleeding and clotting times. Urinalysis

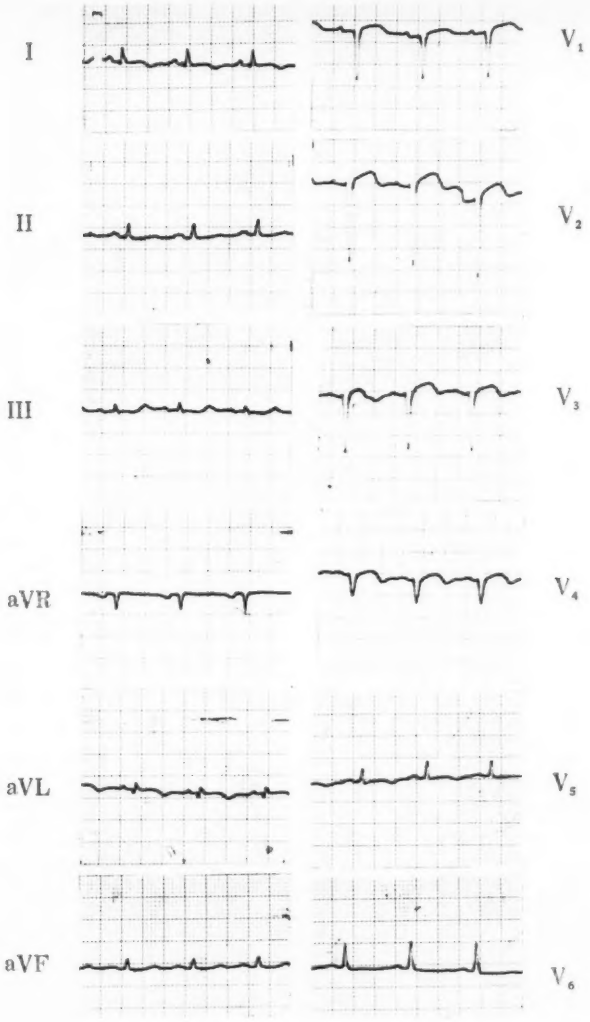

Figure 1. Electrocardiogram taken 13 February 1958 reveals Q wave in aVL; low R wave potential in V_1 to V_3, with failure of R wave progression in V_4; bowed and elevated S–T V_1 to V_4; and T wave symmetrically inverted in leads I and aVL, and diphasic in V_1 through V_5. This was interpreted as compatible with a recent anteroseptal infarction either with an old high lateral component or with inclusion of a high lateral component in the recent infarct.

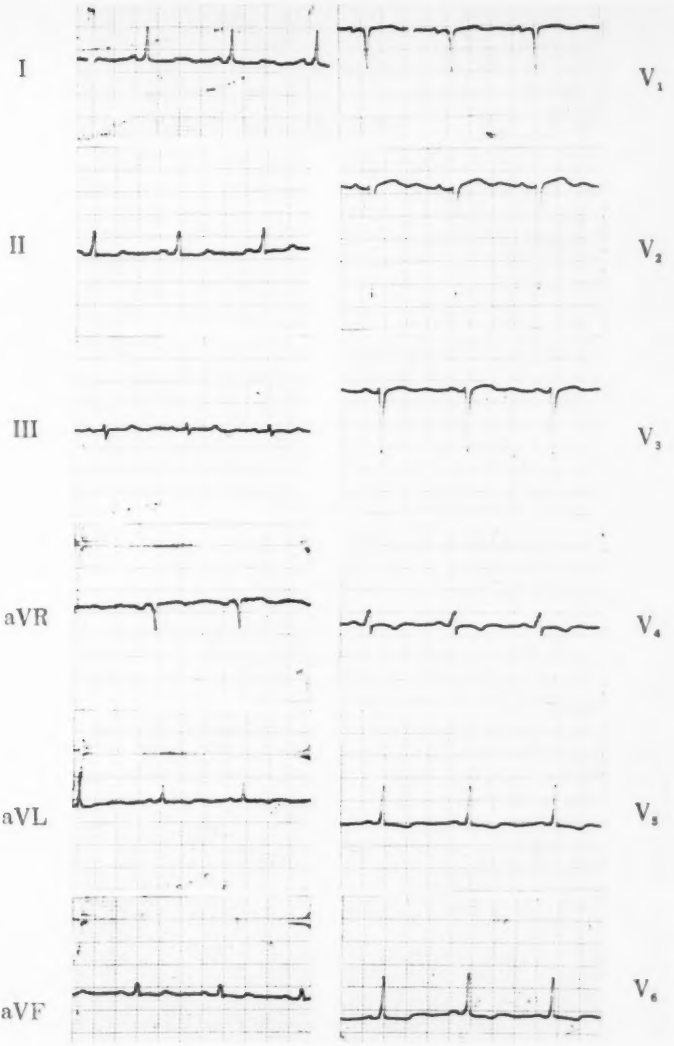

Figure 2. Electrocardiogram taken on 12 March 1958 indicates a return of the S–T segments to the baseline, with persisting inversion of T V_4 to V_6. The Q wave in aVL is no longer apparent and it is felt that V_4 in this tracing was taken from a more lateral position than the preceding one. This was interpreted as compatible with normal resolution in the infarct. U waves are suggested in V_2 and V_3.

was normal. Potassium was 4 mEq/1 (12 May 58), sodium 140 mEq/1, blood urea nitrogen 12.0 mg per 100 ml, carbon dioxide-combining power 16 mEq/1, chlorides 114 mEq/1. Chest roentgenogram revealed diffuse cardiac enlargement, right hilar prominence, and an infiltrate in the third left anterior intercostal space interpreted as old.

On 11 May, prior to barium enema, 3 clear water enemas were administered with ensuing rectal bleeding. The patient began to regurgitate excessively.

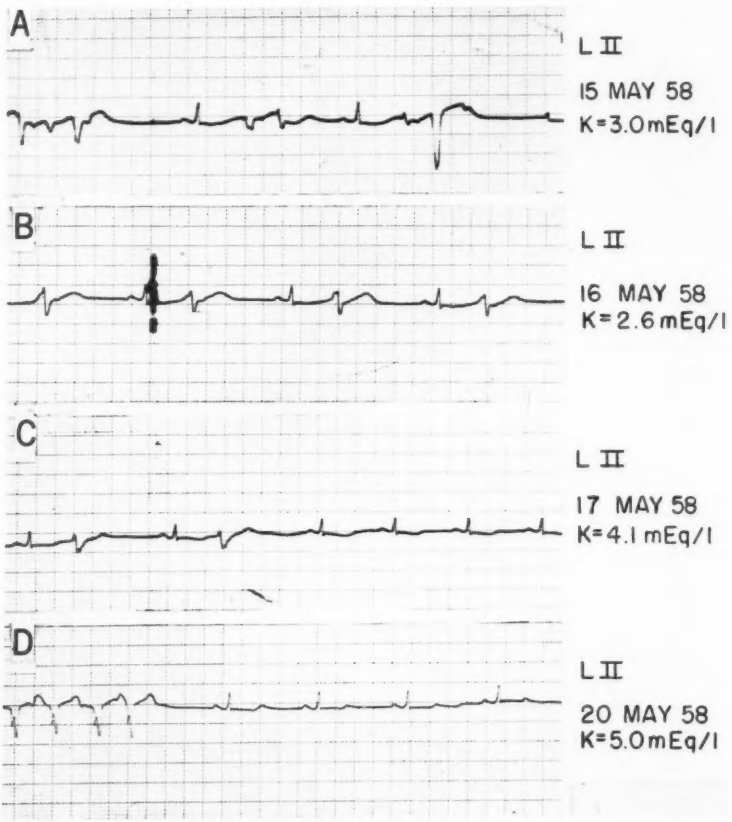

Figure 3. (A) Strip of lead II taken 15 May 1958 reveals frequent premature ventricular contractions from multiple foci. These are bidirectional. (B) Strip of lead II taken 16 May 1958 reveals coupled rhythm with premature ventricular focus (parasystole). (C) Strip of lead II taken 17 May 1958 reveals frequent ventricular premature contractions, but decreasing over that seen previously. (D) Strip of lead II taken 20 May 1958 reveals short run of ventricular tachycardia followed by normal sinus bradycardia.

Electrocardiogram revealed no arrhythmias, and the previously inverted T waves were isoelectric. At sigmoidoscopy a friable, fungating mass was seen 4 inches from the anal verge and on biopsy proved to be rectal adenocarcinoma. Following sigmoidoscopy, the patient received a slow transfusion of 1000 ml of whole blood.

By 14 May vomiting had ceased. Neomycin therapy was initiated for preoperative bowel preparation and diarrhea promptly followed, becoming more severe in the next 3 days. The patient complained of chest pain. Runs of bigeminy were detected and an electrocardiogram on 15 May indicated frequent multifocal premature ventricular beats with occasional dropped beats, nonspecific depression of the ST segment, and depression of the T wave over the left precordium. The electrocardiographic changes were felt to be compatible with digitalis intoxication, diffuse myocardial damage, or both (fig. 3–A). Serum potassium was 3 mEq/1.

On 16 May the electrocardiogram was essentially unchanged (fig. 3–B); serum potassium was 2.6 mEq/1; transaminase was 20 units. On this day the patient experienced a 3-minute episode of cardiac arrest. Emergency resuscitation, consisting of mouth-to-mouth respiration, positive pressure oxygen, and sublingual Isuprel, was successful. Upon regaining consciousness the patient had no complaints beyond weakness. An electrocardiogram at this time continued to show marked bigeminy with bidirectional extrasystoles.

Elixir of potassium chloride was given in doses of 1.2 grams every 6 hours. Within 24 hours the cardiac rhythm returned to normal sinus, with occasional unifocal premature ventricular contractions (fig. 3–C). Blood potassium was now 4.1 mEq/1. During the next 2 days the urinary output remained over 2000 ml and the patient improved. Subsequent electrocardiograms and transaminase determinations revealed no evidence of myocardial infarction (fig. 3–D). Several subsequent blood potassium determinations were within normal range. The patient continued to have 5 to 6 small, mucous, bloody bowel movements daily and remained anorectic. She was transferred to the surgery service on maintenance doses of elixir of potassium chloride (0.9 grams every 6 hours) and digoxin (0.25 mg daily).

On 9 June 1958 anterior resection of the rectosigmoid was performed. During the procedure there were several mild episodes of cardiac irregularity, but the patient withstood the surgical procedure without other difficulty. Postoperative serum electrolyte levels were within normal range, and electrocardiograms were similar to preoperative tracings. The patient was slowly redigitalized and discharged on 10 July 1958 on a daily maintenance dose of 0.25 mg of digoxin.

COMMENT

This case illustrates several methods of acquiring occult potassium depletion. The patient received 3 enemas and experienced nausea with vomiting on the second hospital day. Diarrhea may have been the result of neomycin therapy, rectal adenocarcinoma, or both. On the fourth hospital day her electrocardiogram revealed U waves and evidence of marked digitalis intoxication, with bigeminal and multifocal bidirectional ventricular premature contractions. She experienced an episode of cardiac arrest, presumed to be ventricular fibrillation. This responded to fist percussion, mouth-to-mouth resuscitation

intermittent positive pressure with oxygen, and sublingual Isuprel. She recovered from this episode without central nervous system or cardiac sequelae. When significant hypokalemia was discovered, digoxin was stopped, and the patient was treated with elixir of potassium chloride, with rapid reversion of rhythm to normal. Throughout the 14-day period of hospitalization, she remained anorectic and continued to have 5 to 6 small, mucous, bloody bowel movements every day. Maintained on oral potassium chloride, she tolerated a colectomy with no significant arrhythmias. Postoperatively she was redigitalized and placed on maintenance dosage with no ill effects.

SUMMARY

The relationship between potassium and digitalis is discussed, and the mechanisms of digitalis intoxication are reviewed, with emphasis upon occult potassium depletion. A case of almost fatal digitalis intoxication precipitated by subtle acute potassium depletion is presented.

REFERENCES

1. Withering, W.: *An Account of the Fox Glove, and Some of its Medical Uses* G. G. J. and J. Robinson, Birmingham, England, 1785.
2. Weiss, S.: Effects of digitalis bodies on nervous system: analysis of mechanism of cardiac slowing, nausea, and vomiting, psychosis, and visual disturbance following digitalis therapy. *M. Clin. North America* 15: 963–982, Jan. 1932.
3. Herrmann, G. R., Decherd, G. M., Jr., and McKinley, W. F.: Digitalis poisoning. *J.A.M.A.* 126: 760–762, Nov. 18, 1944; correction 126: 973, Dec. 9, 1944.
4. Stone, J.: Auricular tachycardia and auriculo-ventricular dissociation following 1.2 mg of digitoxin in one dose. *J. Mt. Sinai Hosp.* 14: 924–928, Jan.–Feb., 1948.
5. Batterman, R. C. and Gutner, L. B.: Hitherto undescribed neurological manifestations of digitalis toxicity. *Am. Heart J.* 36: 582–586, Oct. 1948.
6. Batterman, R. C. and Gutner, L. B.: Increasing congestive heart failure: manifestation of digitalis toxicity. *Circulation* 1: 1052–1059, Apr. (pt. 2) 1950.
7. Burwell, W. B. and Hendrix, J. P.: Digitalis poisoning. *Am. J. Med.* 8: 640–657, May 1950.
8. Cole, S. L.: Digitalis intoxication: chronic effects manifested by diarrhea and auricular flutter. *Am. Heart J.* 39: 900–903, June 1950.
9. King, J. T.: Digitalis delirium. *Ann. Int. Med.* 33: 1360–1372, Dec. 1950.
10. Cohen, B. M.: Medical progress; digitalis poisoning and its treatment. *New England J. Med.* 246: 225–230, Feb. 7, 1952; 254–259, Feb. 14, 1952.
11. Lown, B. and Levine, S. A.: Medical progress: current concepts in digitalis therapy. *New England J. Med.* 250: 771–778, May 6; 819–832, May 13; and 866–874, May 20, 1954.
12. Bergy, G. G., Fergus, E. B. and Bruce, R. A.: Acute massive digitoxin

poisoning: report of case and review of literature. *Ann. Int. Med.* 46: 964–976, May 1957.

13. KEYL, A. C.: Digitalis antagonism. *A.M.A. Arch. Int. Med.* 101: 849–854 May 1958.
14. LEVINE, H. D.: Electrolyte imbalance and electrocardiogram. *Mod. Concepts Cardiovas. Dis.* 23: 246–299, Nov. 1954.
15. BELLET, S., STEIGER, W. A., NADLER, C. S. and GAZES, P. C.: Electrocardiogram patterns in hypopotassemia: observations on 79 patients. *Am. J. M. Sc.* 219: 542–558, May 1950.
16. ENSELBERG, C. D., SIMMONS, H. G. and MINTZ, A. A.: Effects of potassium upon heart, with special reference to possibility of treatment of toxic arrhythmias due to digitalis. *Am. Heart J.* 39: 713–728, May 1950.
17. ELKINTON, J. R. and TARAIL, R.: Present status of potassium therapy. *Am. J. Med.* 9: 200–207, Aug. 1950.
18. NICHOPOULOS, G. C. and HOFFMAN, W. K.: Effect of acute hypopotassemia on myocardial potassium and the electrocardiogram. Abstract from 29th Annual Scientific Sessions, Am. Heart A., 1956. *Circulation* 14: 978, Nov. 1956.
19. GAMSTORP, I., HAUGE, M., HELWEG-LARSEN, H. F., MJÖNES, H. and SAGILD, U: Adynamia episodica hereditaria: disease clinically resembling familial periodic paralysis but characterized by increased serum potassium during paralytic attacks. *Am. J. Med.* 23: 385–390, Sept. 1957.
20. SCHWARTZ, W. B., LEVINE, H. D. and RELMAN, A. S.: Electrocardiogram in potassium depletion; its relation to total potassium deficit and serum concentration. *Am. J. Med.* 16: 395–403, Mar. 1954.
21. BETTINGER, J. C., SURAWICZ, B., BRYFOGLE, J. W., ANDERSON, B. N., Jr., and BELLET, S.: Effect of intravenous administration of potassium chloride on ectopic rhythms, ectopic beats and disturbances in A–V conduction. *Am. J. Med.* 21: 521–533, Oct. 1956.
22. WYATT, D., HOIGAE, R. and MERRILL, J. P.: Effects of alterations of body K on digitalis toxicity. Proceedings of 44th Annual Meeting of the American Society for Clinical Investigation, Atlantic City, May 5, 1952. *J. Clin. Invest.* 31: 648, June 1952.
23. BERLINER, R. W.: Symposium on secretion of electrolytes; renal secretions of potassium and hydrogen ions. *Fed. Proc.* 11: 695–700, Sept. 1952.
24. LARAGH, J. H.: Effect of potassium chloride on hyponatremia. *J. Clin. Invest.* 33: 807–818, May 1954.
25. SEVEN, M. J. and JOHNSON, L. A.: Chelation—a broad concept in therapy. Scientific Exhibits, A.M.A. Meeting, San Francisco, June 1958.
26. NADLER, C. S., BELLET, S. and LANNING, M.: Influence of serum potassium and other electrolytes on electrocardiogram in diabetic acidosis. *Am. J. Med.* 5: 838–848, Dec. 1948.
27. BELLET, S., NADLER, C. S., GAZES, P. C. and LANNING, M.: Effect of vomiting due to intestinal obstruction on serum potassium. *Gastroenterology* 12: 49–56, Jan. 1949.
28. PERKINS, J. G., PETERSEN, A. B. and RILEY, J. A.: Renal and cardiac lesions in potassium deficiency due to chronic diarrhea. *Am. J. Med.* 8: 115–123, Jan. 1950.
29. DARROW, D. C.: Physiological basis of potassium therapy. Council on Foods and Nutrition. *J.A.M.A.* 162: 1310–1315, Dec. 1956.
30. RELMAN, A. S. and SCHWARTZ, W. B.: Nephropathy of potassium depletion; clinical and pathological entity. *New England J. Med.* 255: 195–203, Aug. 2, 1956.

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31. Relman, A. S. and Schwartz, W. B.: The kidney in potassium depletion. *Am. J. Med.* 24: 764–773, May 1958.
32. Tauxe, W. N., Wakim, K. G. and Baggenstoss, A. H.: Renal lesion in experimental deficiency of potassium. *Am. J. Clin. Path.* 28: 221–232, Sept. 1957.
33. Artman, E. L. and Wise, R. A.: Hypokalemia in liver cell failure. *Am. J. Med.* 15: 459–467, Oct. 1953.
34. Danowski, T. S.: Newer concepts of role of potassium in disease. *Am. J. Med.* 7: 525–531, Oct. 1949.
35. Lans, H. S., Gollin, H. A., Daro, A. F. and Nora, E., Jr.: Hypokalemia due to persistent vomiting during pregnancy. *J.A.M.A.* 153: 1012–1015, Nov. 14, 1953.
36. August, J. T., Nelson, D. H. and Thorn, G. W.: Aldosterone (concluded). *New England J. Med.* 259: 967–971, Nov. 13, 1958.
37. Brooks, R. V., McSwiney, R. R., Prunty, F. T. G. and Wood, F. J. Y.: Potassium deficiency of renal and adrenal origin. *Am. J. Med.* 23: 391–407, Sept. 1957.
38. Wyngaarden, J. B., Keitel, H. G. and Isselbacher, K. J.: Potassium depletion and alkalosis; their association with hypertension and renal insufficiency. *New England J. Med.* 250: 597–600, Apr. 8, 1954.
39. Aikawa, J. K. and Fitz, R. H.: Exchangeable potassium content of body in congestive failure; changes during treatment. *Circulation* 14: 1093–1098, Dec. 1956.
40. Grob, D., Liljestrand, A. and Johns, R. J.: Potassium movement in normal subjects: effect on muscle function. *Am. J. Med.* 23: 340–355, Sept. 1957.
41. Schwartz, W. B. and Relman, A. S.: Electrolyte disturbances in congestive heart failure; clinical significance and management. *J.A.M.A.* 154: 1237–1241, Apr. 10, 1954.
42. Pitts, R. F.: Some reflections on mechanisms of action of diuretics. *Am. J. Med.* 24: 745–763, May 1958.
43. Schwartz, W. B. and Relman, A. S.: Metabolic and renal studies in chronic potassium depletion resulting from overuse of laxatives. *J. Clin. Invest.* 32: 258–271, Mar. 1953.
44. Perrot, R. M., Moreau-Gaudry, G. and Le Borgne, Y.: Manifestations cardiaques d'hypokaliémie dans la cure à la chlorpromazine. *Presse méd.* 64: 2076, Dec. 12, 1956.
45. Page, E.: Precipitation of ventricular arrhythmias due to digitalis by carbohydrate administration. *Am. J. Med.* 19: 169–176, Aug. 1955.
46. Kohn, R. M. and Kiley, J. E.: Electrocardiographic changes during hemodialysis with observations on contribution of electrolyte disturbances to digitalis toxicity. *Ann. Int. Med.* 39: 38–50, July 1953.
47. Young, J. V. and Daugherty, G. W.: Use of artificial kidney in production and study of experimental hypokalemia. *Proc. Staff Meet. Mayo Clin.* 31: 357–364, June 13, 1956.
48. Rubin, A. L., Lubash, G. D., Cohen, B. D., Brailovsky, D., Braveman, W. S. and Luckey, E. H.: Electrocardiographic changes during hemodialysis with artificial kidney. *Circulation* 18: 227–234, Aug. 1958.
49. Bernreiter, M. and Calovich, E. R.: Hyperpotassemia and hypopotassemia in case of anuria followed by severe diuresis; electrocardiographic changes. *J.A.M.A.* 147: 1036–1038, Nov. 10, 1951.

Nutritional Aspects of the All-Purpose Survival Ration

A Critical Appraisal

DORIS HOWES CALLOWAY, PH.D.

ARMED FORCES interest in short-term emergency feeding has centered about the problems faced in a survival situation by military personnel—the men who abandon ship and are castaway on salt water; men who ditch aircraft over any terrain from desert to Arctic; and small parties cut off from normal resupply channels in combat. Similar problems would be present in a civilian crisis resulting from war or a major disaster.

Because the space available for emergency supplies is severely limited, consideration of the relative importance of survival components is critical. In most cases, protection from the environment is most important. For the man ditched in the icy waters of the North Atlantic, escape time may be measured in minutes. In other areas of more generous geography, protection from sun, storms, sharks, and scorpions must be provided. Thus, a portion of the available space must be given to shelter, sleeping gear, repellents, and a few tools. Provision of rescue-aiding equipment such as flares and markers is an obvious necessity. Most of the remaining space must be given to water or means of obtaining it.

Last of all comes food. There is little evidence that more than a token food supply is essential to man's survival for brief periods. Among survival experiences reported by the U.S. Air Force [1] was one in which a group of 3 men survived the rigors of arctic weather without fuel or shelter for 10 days, on an average daily intake of

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less than 100 calories of malted milk tablets. The men were in grave condition when rescued, suffering from exposure and frostbite, but they survived. In another instance, 4 men lived under similar climatic conditions, but with the shelter of their aircraft and its fuel, for almost 2 months, during the last 17 days of which they had no food; these men died.

Obviously, sustaining life under these conditions was not without a price. Whether a slightly increased food supply would have appreciably altered the course of events is worthy of debate. As a result of experience gained in a survival field test in which the men first fasted for 2 days, the Royal Canadian Air Force [2] concluded: "The abrupt improvement in morale with the commencement of limited feeding shows the psychological value of including food in a survival pack." Certain physiologic evidence also suggests a positive need for food.

REQUIREMENT FOR FOOD

Much data have been accumulated on responses of animals and man to acute starvation, and to various lesser levels of caloric insufficiency. We shall concern ourselves only with more recent studies in which some attempt was made to evaluate man's ability to perform physically, since this ability is determinant in survival.

Table 1. ***Performance capacity of 12 men during a 4½-day fast with hard work****

Performance	*Control*	*S2***	*S3*	*S4*	*R5***
SUSTAINED WORK					
Work pulse, beats per min	129±9	145	144	151	124
Recovery pulse, beats per min	101±14	120	121	125	87
Blood sugar (work), mg per 100 ml	80±3	53	59	62	–
EXHAUSTING WORK					
Score	72.1±20.6	47.8	–	40.5	75.3
Time of run, sec	240±61	163	–	134	239
Bodyweight, kg	70.5±4.7	68.5	67.0	65.9	70.6

*Adapted from Henschel, Taylor and Keys.[3]
**S refers to day of starvation, R to recovery.

A series of tests on total starvation, in which no water limitation was imposed, were conducted under laboratory conditions at the University of Minnesota.[3–6] The trained, physically fit young subjects were required to do about 2,500 calories of work daily, for 3 to 5 days. Some criteria used to evaluate fitness are presented in table 1,

together with results of the tests. The investigators noted no significant changes during the first day of fasting. On the morning of the second day, aerobic work pulse rates were increased 10 to 15 beats per minute and the blood sugar in work decreased 25 mg per 100 ml. Essentially, no further change in this regard was noted. The ability to perform exhaustive anaerobic work was definitely impaired on the second day and continued to diminish through the fourth day. During performance of work, nausea and vomiting were frequently encountered. As measured by dynamometers, strength was not impaired, but maximal speed of motion (tapping test), and eye-to-hand coordination were reduced parallel to the decrease in blood sugar.

The authors suggested that acidosis and dehydration were the factors primarily responsible for the observed decrements in performance. This view is supported by the findings of Young and Spector,[7] who observed that in dogs, a species in whom marked ketosis does not accompany fasting, aerobic work performance was not impaired by 2 weeks of starvation. Data obtained in man by Sargent and co-workers,[8] both in the laboratory and in the field, produced similar conclusions.

In practical terms, we find that men with no food can perform adequately for 1 day. They can continue to perform sustained physical work at greater physiologic cost for several days, but are less able to complete activities requiring spurts of high energy. Decrements in reaction time and coordination suggest that the ability to perform such important tasks as hitting a target would be impaired. Logic, therefore, requires that some food should be provided. The question becomes how much of what? Before we can approach this problem intelligently, the relative need for water has to be considered, since space provided for one is at the expense of space for the other.

REQUIREMENT FOR WATER

A brief review of the components of water exchange, presented in figure 1 as modified from Gamble,[9] shows the dehydration of starvation. Removal of body-fluid solutes was accomplished at a loss of 550 ml of body water. A daily intake of about 800 ml was necessary to prevent the further loss of body water depicted in the second pair of bars, which show the added condition of thirst. Of the avenues of water loss, only the smaller component, urine volume, can be modified by dietary adjustments.

The rate at which an incapacitating loss of body water is reached is dependent chiefly on the volume of the evaporative loss. The amount of this extrarenal output depends, in turn, upon the ambient

temperature and the amount of work performed. With 8 hours of hard work in a hot environment, sweat loss may be 12 to 16 liters per day. Sweating is also increased during hard work in the Arctic, because of the insulating properties of the protective clothing.

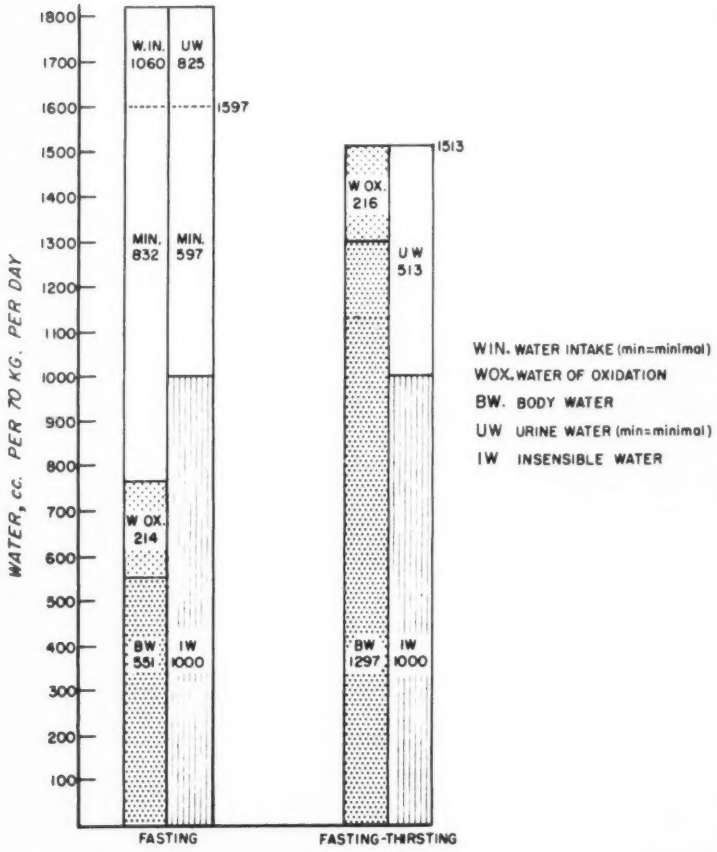

Figure 1. Components of water exchange and dehydration of starvation. Redrawn from Gamble.[9]

Major reduction in both routes of evaporative loss is observed, however, when water is restricted. Figure 2 shows the minimal levels achieved when water intake was reduced to 1,800 or 900 ml

per day.[10] By this conservation, over 1 liter of water per day was spared, but the reduced sweating rate resulted in a rise in body temperature during work, with increased pulse and respiration rates. Evidence indicates that the loss of 8 to 10 percent body weight as water is incompatible with sustained performance. It is apparent that the primary requirement of the survival ration is that it must not interfere with conservation of body water.

COMPOSITION OF THE RATION

We are indebted to Gamble's group for data basic to the construction of a survival ration. These workers demonstrated conclusively that

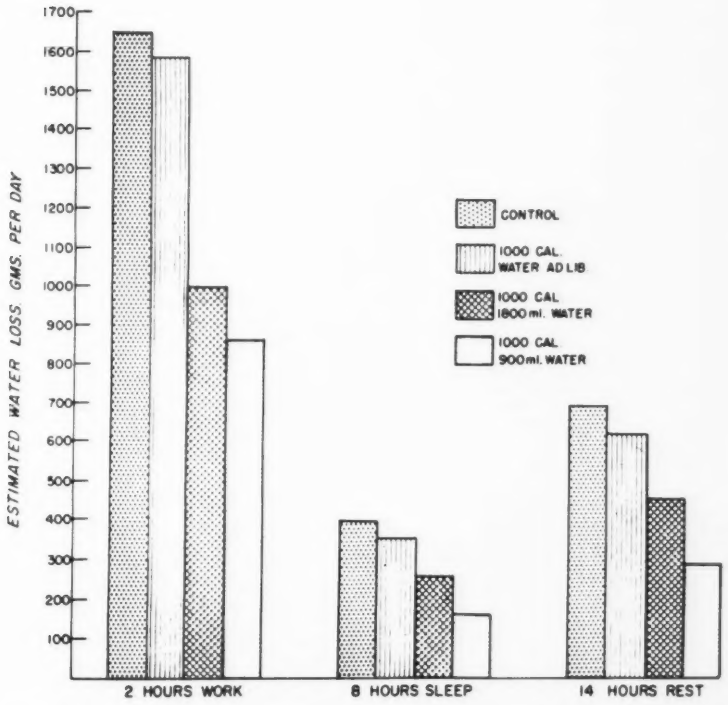

Figure 2. Estimated minimal fluid loss when food was restricted and water intake was reduced to 1,800 or 900 ml per day. Adapted from Grande, et al.[10]

100 grams of carbohydrate reduced the deficit of body water by lowering the amount of body solutes claiming excretion and by preventing ketosis, thus permitting a reduction in urine volume.[9] Henschel, Taylor and Keys,[3] found that the loss of speed and coordination in their fasted subjects could also be reversed by administration of 100 grams of sugar.

There can be no question that 100 grams of carbohydrate constitutes the minimal essential ration under any set of conditions. Such a ration has, in fact, been tested in the field many times with success. U.S. Navy trials [11] were carried out in 1951 at Balboa, Canal Zone (moderate heat 74° to 89°F) and at Argentia, Newfoundland (moderate cold, 37° to 50°F), where the men were given about 300 calories (60 grams carbohydrate) daily, with a total of 4 pints of water allowed for the 5-day period. Maximum body weight loss was roughly 8 percent, and none of the 10 subjects was incapacitated. Acetonuria was present in 9 subjects at Argentia but was less pronounced at Balboa. The Royal Canadian Air Force evaluated a similar ration in 1952 [2] and again in 1958,[12] concluding on both occassions that this ration was adequate for survival periods of 7 to 10 days during the Canadian summer (temperature 52° to 76°F, water as needed). The U.S. Air Force found, during a 10-day trial in the Alaskan winter, that the physical fitness index of test subjects fed such a ration was unimpaired.[13] The chief complaints were that this ration imposed a very large caloric deficit, and failed completely to prevent ketosis.

In view of this evidence, the continued search for an improved ration of universal applicability may seem unwarranted. This position has been held by the Navy, with acknowledgment of the fact that survival does not necessarily mean survival in perfectly fit condition. However, the Air Force wishes to maintain castaways more nearly in nitrogen balance, caloric balance, and water balance, so that survivors can undertake more active efforts of escape and evasion. The Navy envisions a 5-day period of search and rescue, while the Air Force anticipates 4 days of active or 10 days of static survival.[14, 15] In order to meet these different requirements, the practicality of incorporating other nutrients into the ration was examined.

First, replacement of salt was considered as an aid in reducing water loss and as the change least costly of space. Gamble's [9] findings in this regard are shown in figure 3. More body sodium and extracellular water was conserved in the fasting subject by 100 grams of glucose than by 4.5 grams of sodium chloride. When sodium chloride was given with glucose, all extracellular water loss was prevented. However, the loss of potassium, and consequently of intracellular fluid, was increased, leading the author to conclude

that this was "an unsound physiological bargain." Issue has been taken with this view by Taylor,[16] who reported no aberration when sodium chloride was given to men on limited intakes of carbohydrate and no added benefit from replacement of sodium chloride by potassium chloride (3.75 grams) plus magnesium oxide (360 mg). Sargent and co-workers [8] have also indicated that an all-carbohydrate ration contains too little osmotically active material and accentuates dehydration.

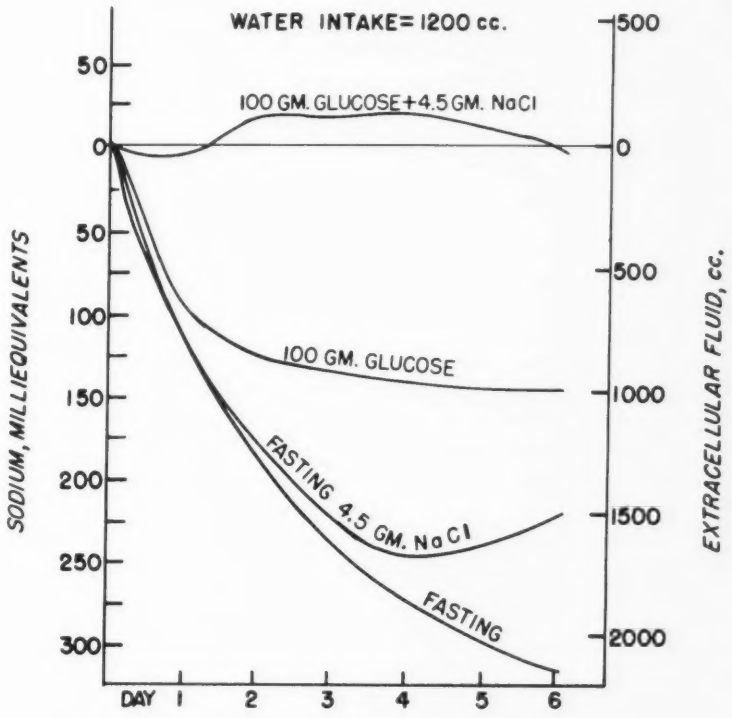

Figure 3. Cumulative losses of sodium and extracellular water. Redrawn from Gamble.[9]

Another obvious modification is a simple increase in energy supply. The Minnesota group [17] made precisely this comparison. Young men received a carbohydrate ration with 4.5 grams of salt and a vitamin supplement for either 12 days at 580 calories per day or 24 days at 1,010 calories per day. Assigned treadmill work output was 1,200

calories per day. The capacity to perform work was well maintained in both groups, but pulmonary ventilation during work, oxygen debt, and pulse rate responses to a fixed task indicated some deterioration at the lower caloric level. No evidence of poor physiologic response to the stress of work was noted at the higher intake level. The investigators concluded that "when sufficient calories and sodium chloride in the presence of an adequate vitamin intake are provided to prevent ketosis, dehydration and hypoglycemia under conditions of moderate energy output, performance capacity is well maintained up to a weight loss of 10 percent of the original body weight."

Addition of protein and fat to the ration is a matter to be approached with some caution, since the most widely divergent views among investigators and agencies revolve about this problem. The classical studies of Gamble [9] showed that at a very low calorie level, a protein intake did not appreciably preserve body protein and that removal of the urea formed increased the renal water requirement. Later, Schwimmer and McGavack [18] reported that nitrogen balance was definitely improved by incorporation of 45 grams of high-quality protein in a 30 percent-fat, 900-calorie ration. This finding was re-examined by the original investigators and by the Quartermaster Environmental Protection Research Division early in the 1950's. Both agreed that there was no significant difference in nitrogen loss between a protein-containing and a protein-free 900-calorie ration with either 800 or 1,800 ml of water per day.[19, 20, 21] Ketosis occurred only in the protein-fed group and when water was limited, body-water losses were greater in this group than in the protein-free group. It was recommended that protein be omitted from rations of 900 calories or less.[20, 21]

At this time the Air Force also undertook an evaluation of nutrient mixtures for survival rations. These studies by Sargent and co-workers [8] encompassed 4 nutrient mixtures, ranging from an all-carbohydrate, salt-free ration to a high-protein, high-fat pemmican type; 4 calorie levels (0 to 3,000); 3 climates; 2 physical work levels; and 2 water levels. Their "normal" nutrient mixture, with 15 percent of the calories derived from protein, 52 percent from carbohydrate, and 33 percent from fat, most adequately fulfilled the battery of equally weighted criteria selected from among the many responses evaluated. Others have taken issue, not with the data obtained, but with the evaluation of these data.[16] It has been pointed out that for survival potential, a negative nitrogen balance cannot be considered equal to a negative water balance. The poorer performance of the all-carbohydrate ration in this test than in others may have been attributable to the deficiency in salt noted earlier.

The pemmican or meat-bar ration, too high in osmotically active material, was also deemed inadvisable.

In direct opposition to these findings are those of Drury, Vaughan and Hannon [22] of the U.S. Air Force Arctic Aeromedical Laboratory. Their test was conducted under severely cold (+14° to −55° F) field conditions, with a 1,000-calorie ration derived exclusively from pemmican making up the diet of a group of 5 young men. A 40-gram sugar allowance replaced 1 ounce of the pemmican issue in a second group. Neither the level of fluid intake nor the output was reported. Fasting blood-sugar level was somewhat higher and ketone production somewhat lower in the group given the sugar supplement, but the groups did not vary in any other measured characteristic. Over-all performance of both groups was rated adequate for most Arctic survival situations. All physiologic changes leveled off or reversed direction toward a more normal level after the third day of the 9-day test, which was interpreted as evidence of adaptation to the high-fat, high-protein, low-caloric diet. In actual experience, most rescues were accomplished within the period required for adjustment to the pemmican diet, so that it would seem desirable to obviate the necessity for this adaptation by supplying a more usual diet. However, the concept of adaptation to calorically restricted diets is an intriguing one. Several workers [5, 23, 24] have reported that subjects previously exposed to limited food intakes showed reduced nitrogen excretion, less severe ketosis, and more adequate blood-sugar levels on subsequent repeated treatment. If such biologic memory is maintained for a sufficient period of time, it might be advantageous to pre-expose men to stress which they may later encounter. Further evidence on this point is needed.

An attempt was made earlier to resolve the question of nitrogen balance during caloric insufficiency by review and analysis of the data then available.[25] The experiments cited above did not yield information differing in any important regard from that published prior to 1954. Since this analysis suggested the formulation of the All-Purpose Survival Ration currently being offered to the various services, the pertinent conclusions are quoted below:

> For young, essentially normal, active men, when no nitrogen is fed, the protein deficit (negative nitrogen balance) can be maximally reduced by supplying about 700 nonprotein calories. No significant protein-sparing is achieved by intakes as high as 2,800 calories in the absence of protein. . . . An intake of approximately 900 calories was the lowest level at which the addition of protein to the diet produced noticeably less negative nitrogen balance than the same number of protein-free calories. At this calorie level the same reduction in negativity of nitrogen balance occurred with 3 grams

> as with 6 grams of nitrogen fed. . . . It is apparent that [excess] protein fed under these circumstances is largely burned as an energy source, producing a concomitant rise in urinary nitrogen excretion [and obligatory urine volume].

These relationships are illustrated in figure 4. A food unit, in which 7 to 8 percent of the calories are derived from protein, could be consumed in any multiple number with maximum benefit from the protein at each energy level and without damage to the water economy. The flexibility of a unit system permits adjustment of the level of issue with regard to the number of people to be fed from available supplies and the energy expenditure required of the survivors.

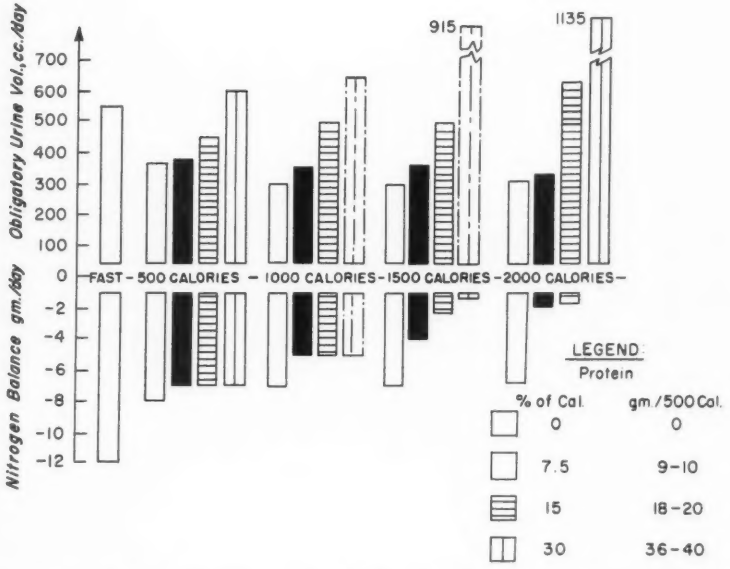

Figure 4. Calculated alteration in obligatory urine volume compared with nitrogen deficit at varying intakes of protein and calories. From Calloway and Spector.[25]

Provided that sufficient carbohydrate is supplied to prevent ketosis and promote protein utilization, the amount of fat in the ration may be adjusted to achieve maximum caloric density consistent with palatability. Although it was reported that a diet containing 30 per-

cent fat was more effective in promoting nitrogen utilization than one containing 10 percent,[18] an extensive review of the literature [26] indicated that there is essentially no difference between carbohydrate and fat in this regard. All food items of the ration should be of uniform composition because energy and protein must be available simultaneously for maximum utilization.[27] This arrangement also prevents dietary imbalance resulting from individual taste preferences or from the need for subdividing a ration.

COMPONENTS OF THE PROTOTYPE RATION

Drafting the specification for a prototype ration demands the integration of all military requirements. So far we have dealt only with nutritional design. This design must be converted into components of sufficient acceptability, stability, and military utility to permit the ration to be used successfully. For this ration, some compromise with the concept of nutritional adequacy has been made; it is probable that a similar compromise in the area of palatability can be accepted. The technologists concerned with developing the ration cannot, however, escape the requirements of stability and utility.

The Quartermaster Food and Container Institute for the Armed Forces was instructed to produce a variety of survival items that would have the maximum feasible caloric density; not provoke undue thirst; meet the designated approximate composition and contain about 0.7 to 1.4 percent salt; fit into a small rectangular can; withstand storage in the range of −80° to 160° F; and taste in part like food rather than confection. Six bars were created, 4 of which were packed in the can with some soluble coffee and sugar, yielding 937 calories in less than one-half pound of food weight. This prototype ration was then field tested for palatability and utility.

In the 3 tests conducted with U.S. Air Force and Army personnel, 1 or 2 rations were issued per day for 4-, 7-, or 10-day periods of simulated survival.[28] Water was unlimited, or restricted to 1 ml per calorie of issue. No physiologic measurements were recorded. Two of the bars—the meat flavored and the potato flake—were so universally disliked that their exclusion from the ration was recommended. Rejection of these bars increased at the higher calorie level and in the presence of water restriction. Average rejection of the other bars was only 8 percent. Among men issued 1 ration daily for 10 days, there was no rejection of the 4 palatable bars at either level of water.

The Royal Canadian Air Force evaluated the prototype ration in comparison with their own AFFP III Survival Ration.[2] Body weight losses were similar in both groups. Some food rejection occurred in

both groups, but the Canadian ration was rated more acceptable over-all. Chicken soup was a popular component of that ration, emphasizing that hot drinks are highly desirable in survival conditions. It was believed that the addition of a small amount of salt to the U.S. ration would be an improvement.

RECOMMENDED MODIFICATIONS

Because of poor field acceptance, 2 of the bars of the prototype ration are being replaced by 2 new bars for which improved acceptance is predicted. This is a straightforward modification.

Various means of supplying additional salt have been considered. For Navy use probably no more salt is wanted, because of the amount inadvertently consumed from exposure to sea-water spray. Increasing the salt level of the bars is not feasible. Sodium chloride tablets were shown to be poorly tolerated, saline solution was nauseous, and enteric-coated pills were found intact in the feces of some of the subjects at Minnesota.[29] A packet of bouillon (soup and gravy base or chicken-soup mix), which contains about 3 grams of sodium chloride, would appear to be a most acceptable carrier of additional salt: the soup need not be consumed if the salt level is to be kept low, the item is already in normal supply channels, the packet requires little space, and the soup fulfills the need for a hot beverage. Some additional minerals are naturally contained in the bars. Insufficient evidence is available on which to base a recommendation for fortification with potassium or other salts. We would be grateful if one of our colleagues would determine the absolute requirement and the desirable ratios of minerals for survival conditions, but the need does not seem critical for the short haul.

Reappraisal of physiologic findings thus far acquired does not inspire us to modify our recommendation with regard to protein content of the ration. Unless an ample supply of water can be absolutely assured the risks produced by high protein seem unnecessarily high in proportion to the benefits. If the survivor can "live off the land" at all, his chief supplementary food is likely to be high in protein—fish, flesh, or fowl—and his intake thereby augmented.

The question of vitamins has never been raised seriously, nor is there any need for them when maximum period of ration use is set at 10 days. Provision of a vitamin pill is a nicety to which there is no objection if the users desire it. The beverages routinely include ascorbic acid, and a certain amount of vitamins A and B is already provided by the bars.

Table 2. ***All-Purpose Survival Ration, 1959 prototype***

Component	*Weight*		*Calories*	*Protein (grams)*	*Fat (grams)*	*Carbohydrate (grams)*	*Sodium (mg)*	*Potassium (mg)*
	(oz)	*(grams)*						
Cereal bar no. 1	1.95	55.2	252	4.1	8.9	38.9	(298)*	(55)*
Cereal bar no. 2	1.95	55.2	258	4.5	9.5	38.8	298	55
Cheese bar	1.20	34.0	152	2.7	4.5	25.1	139	112
Bacon bar	1.16	33.0	147	2.2	4.2	25.0	314	89
Fruitcake bar	1.63	46.3	183	3.6	4.8	31.4	130	69
Chocolate fudge bar	2.00	56.7	234	4.5	5.8	41.0	204	176
4 average bars	6.60	186.8	816	14.4	25.2	133.6	922	371
Soluble coffee	0.09	2.5	4	–	trace	0.9	trace	37
Sugar	0.21	6.0	24	–	–	6.0	–	–
Chicken-soup base	0.25	7.0	19	0.6	0.7	2.5	1056	7
Total	7.15	202.3	863	15.0	25.9	143.0	1978**	415

*values imputed from analysis of cereal bar no. 1.
**or 5.03 grams sodium chloride.

The All-Purpose Survival Ration, now in procurement and being offered for user testing, consists of 4 bars of uniform composition, supplying about 900 calories, 8 percent of which are derived from protein, and 2 grams of sodium chloride (see table 2). The Air Force and the Army may issue 1 or 2 rations per man per day with benefit; the Navy may supply 1 ration per man per 2 days without causing damage. Coffee, tea, and bouillon are provided for personal comfort and an additional 3 grams of salt are contributed by the soup. Adoption of this ration will diminish the logistic burden from 5 specialized survival packets to a single unit and will also eliminate the necessity for changing survival gear when operations shift from one geographic area to another.

SUMMARY

Recent research studies bearing on the need for and composition of a universal survival ration have been reviewed. It is concluded that a minimal supply of food is required under survival conditions to aid morale and to ameliorate the sequelae of starvation—ketosis, dehydration, and reduced work efficiency. To assure that the food will not impair water economy, the following composition is recommended: 1) a maximum of 7 to 8 percent of total calories as protein; 2) a minimum of 75 to 100 grams of carbohydrate; and 3) approximately 4.5 grams of sodium chloride. The components of a prototype All-Purpose Survival Ration are described.

REFERENCES

1. South, O. P.: Arctic Survival and Rescue Reports. North Atlantic Area. Documentary Research Division, Air University, Maxwell Air Force Base, Ala., July 1949.
2. Wickett, J. C. and Bliss, J. Q.: Survival Feeding Trial of R.C.A.F. Seat Pack Ration, Report I.A.M. No. 52/4. Institute of Aviation Medicine and Defense Research Medical Laboratories, R.C.A.F., Toronto, 8 Dec. 1952.
3. Henschel, A., Taylor, H. L. and Keys, A.: Performance capacity in acute starvation with hard work. *J. Appl. Physiol.* 6: 624–633, April 1954.
4. Taylor, H. L., Henschel, A. and Keys, A.: Some effects of acute starvation with hard work on body weight, body fluids and metabolism. *J. Appl. Physiol.* 6: 613–623, April 1954.
5. Taylor, H. L., Brozek, J., Henschel, A., Mickelsen, O. and Keys, A.: Effects of successive fasts on ability of men to withstand fasting during hard work. *Am. J. Physiol.* 143: 148–155, Jan. 1945.
6. Guetzkow, H., Taylor, H. L., Brozek, J. and Keys, A.: Relationship of speed of motor reaction to blood sugar level during acute starvation in man. *Fed. Proc.* 4: 28, March 1945.
7. Young, D. R.: Effect of food deprivation on treadmill running in dogs. *J. Appl. Physiol.* 14: 1018–1022, Nov. 1959.
8. Sargent, F. I., Sargent, V. W., Johnson, R. E. and Stolpe, S. G.: The Physiological Basis for Various Constituents in Survival Rations. Parts I–IV. Wright Air Development Center Technical Report No. 53-484, 1954–1957.
9. Gamble, J. L.: Physiological information from studies on the life raft ration. *The Harvey Lecture Series* 42: 247–273, 1946–1947.
10. Grande, F., Taylor, H. L., Anderson, J. T., Buskirk, E. and Keys, A.: Water exchange in men on a restricted water intake and a low calorie carbohydrate diet accompanied by physical work. *J. Appl. Physiol.* 12: 202–210, Mar. 1958.
11. Minard, D. and Schlang, H. A.: Effects of simulated survival conditions on water balance and metabolism in human volunteers, in Proceedings of the Survival Ration Conference. Quartermaster Food and Container Institute for the Armed Forces, May 1951. *Activities Report* 3: 160–165, Oct. 1951.
12. Coyne, J. P.: A Report of Survival Equipment Trials, 29 May 1958-5 June 1958, Report No. 58/5, Institute of Aviation Medicine, R.C.A.F., Toronto, 20 Oct. 1958.
13. Dyme, H. C.: Arctic Field Trial of USAF Survival Rations, Blair Lake, Alaska, January 1950. U.S. Air Force Technical Report No. 6019, Aug. 1950.
14. Clague, J. A.: Exposition of desired characteristics by services, in Proceedings of the Survival Ration Conference, Quartermaster Food and Container Institute for the Armed Forces, May 1951. *Activities Report* 3: 165–167, Oct. 1951.
15. Proposal for a prototype survival ration, summary of the round table discussion, in Proceedings of the Survival Ration Conference, Quartermaster Food and Container Institute for the Armed Forces, May 1951. *Activities Report* 3: 172, Oct. 1951.
16. Taylor, H. L.: Conference Notes, Coordination Meeting on the Assignment

to the Army of Primary Responsibility for Research & Development in the Field of Food, 21–22 May 1957 at Natick, Mass., pp. 14; 32, Oct. 1957.
17. TAYLOR, H. L., BUSKIRK, E. R., BROZEK, J., ANDERSON, J. T. and GRANDE, F.: Performance capacity and effects of caloric restriction with hard physical work on young men. *J. Appl. Physiol.* 10: 421–429, May 1957.
18. SCHWIMMER, D. and MCGAVACK, T. H.: Protein Metabolism Studies on Reduced Caloric and Water Intakes. Committee on Food Research, Quartermaster Food and Container Institute, File N–1112, Report No. 5, Aug. 1948.
19. SCHWIMMER, D., MCGAVACK, T. H., BOYD, L. J., RUBIN, S. H. and Pearson, S.: Protein Metabolism at Low Caloric Intakes. Quartermaster Food and Container Institute Contract, File N–1124, Report No. 4, 1953.
20. QUINN, M., KLEEMAN, C. R., BASS, D. E., and HENSCHEL, A.: Nitrogen, water and electrolyte metabolism on protein and protein-free low-calorie diets in man; water restriction. *Metabolism* 3: 49–67, Jan. 1954.
21. QUINN, M., KLEEMAN, C. R., BASS, D. E. and HENSCHEL, A.: Nitrogen, water and electrolyte metabolism on protein and protein-free low-calorie diets in man; adequate water intake. *Metabolism* 3: 68–77, Jan. 1954.
22. DRURY, H. F., VAUGHAN, D. A. and HANNON, J. P.: Some metabolic effects of a high-fat, high-protein diet during semi-starvation under winter field conditions. *J. Nutrition* 67: 85–97, Jan. 1959.
23. FOLIN, O. and DENIS, W.: On starvation and obesity, with special reference to acidosis. *J. Biol. Chem.* 21: 183–192, Jan. 1915.
24. VAUGHAN, D. A., DRURY, H. F., HANNON, J. P., VAUGHAN, L. N. and LARSON, A. M.: Some biochemical effects of restricted diets during successive field trials in winter. *J. Nutrition* 67: 99–108, Jan. 1959.
25. CALLOWAY, D. H. and SPECTOR, H.: Nitrogen balance as related to caloric and protein intake in active young men. *Am. J. Clin. Nutrition* 2: 405–411, Nov.–Dec. 1954.
26. MUNRO, H. N.: Carbohydrate and fat as factors in protein utilization and metabolism. *Physiol. Rev.* 31: 449–488, Oct. 1951.
27. CUTHBERTSON, D. P. and MUNRO, H. N.: Relationship of carbohydrate metabolism to protein metabolism, roles of dietary carbohydrate and of surfeit carbohydrate in protein metabolism. *Biochem. J.* 33: 128–142, Jan. 1939.
28. KAMEN, J.: Preliminary Field Evaluation of All-Purpose Survival Ration Prototype. Quartermaster Food and Container Institute Report No. 29–58, Dec. 1958.
29. BROZEK, J., GRANDE, F., TAYLOR, H. L., ANDERSON, J. T., BUSKIRK, E. R. and KEYS, A.: Changes in body weight and body dimensions in men performing work on a low calorie carbohydrate diet. *J. Appl. Physiol.* 10: 412–420, May 1957.

A TRIBUTE TO MARIE CURIE

When Marie Curie died some 35 years ago, none other than Albert Einstein paid her the tribute of a tear, for he lamented the passing of "one whose soul was never corrupted by power, and whose mind was never sullied by envy."—JAMES GEAR: "And let us now praise famous men . . ." *South African Practitioner*, October 1959.

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Potability Tests of Water Supplies in Alaska

CAPTAIN FRANCIS J. SMITH, USAF, MSC

TO BE ADEQUATE, a water supply must be sufficient to carry out all necessary culinary, sanitary, and esthetic requirements without austerity. Water of good quality is clear, colorless, with no objectionable taste or odor, and—most important—bacteriologically and chemically safe. Because of events since World War II, the U.S. Air Force has been forced to expand its activities in areas such as Alaska, where both the quantity and the quality of the water supply are problems.

The major land mass of Alaska is in the permafrost zone. The subsurface remains frozen throughout the year, precluding the development of dependable year-round ground water sources in some areas. In winter, lakes and impounded waters freeze to great depths. The formation of ice concentrates most of the solids into the underlying water, making it corrosive and nonpalatable. Melting snow is an auxiliary source in winter. Occasionally, at the smaller installations, it is necessary to reclaim water that infiltrates utility tunnels and pump it to storage tanks.

The 3 Alaskan Air Command bases that support a large population are able to supply a sufficient quantity of good water. The remaining Air Force stations, which number more than 24, have somewhat over 20 individuals at detachments and between 100 and 150 individuals at the average installation. The largest, few in number and primarily radar sites, support between 200 and 300 people. Their mission requirements dictate their placement in an integrated network to provide overlapping radar coverage. Most are a significant distance from the main bases and from developed civilian communities, only 2 being accessible by road from the main bases. The remainder

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may be reached only by air the year round and by ship during the shipping season.

With limited personnel on duty at these inaccessible sites, the maintenance of the personnel's physical and mental well-being assumes exceptional importance. A satisfactory method for testing water supplies for potability is a matter of grave concern to the U.S. Air Force in Alaska.

Many of the sites are divided into a main and one or more subsidiary camps. Water and other utilities are distributed throughout the former by insulated tunnels (utilidors). Hot water and steam lines protect against freezing. Pressure is maintained in the water system by a pressure tank using compressed air or nitrogen. Water is supplied to the subsidiary camps by tank trucks, tramways, or tanks mounted on sleds. Such methods of distribution expose the water to many sources of contamination. Hoses, piping connections, and filling facilities are often improvised and may be easily contaminated.

Although all supplies are chlorinated as required by Air Force policy,[1] some of the original installations provided for chlorination as the water left the storage tank, allowing insufficient contact time with the chlorine. Water distributed to subsidiary camps is also treated with chlorine, but an effective chlorine residual is difficult to maintain because of low water temperature, handling, pumping, and heating to relatively high temperature to prevent freezing in transit during the winter.[2] Rechlorination before use is usually mandatory.

Water storage at the sites provides a supply sufficient for from 4 days to 6 months, depending on the reliability of the source. Where the source freezes in winter, storage has been or is being provided to carry the site over the period of freeze without melting snow. An example of this type of installation is Cape Lisburne Air Force Station on the Arctic Ocean, north of Bering Straits. Prior to the winter of 1958–59, approximately 600,000 gallons of potable water storage plus 60,000 gallons of water for fire protection was available. This required severe water rationing and the use of a snow melter, which gave the water an objectionable taste and odor and created a sanitation problem. Because of the foreign matter introduced by the melter, the immediate chlorine demand rose from less than 1 ppm in summer to 10 ppm. In the fall of 1958 storage facility for an additional 800,000 gallons was completed, eliminating or greatly reducing the use of snow melters and carrying the site over the winter without severe austerity. The new storage tanks are well designed and safe from contamination.

Until the spring of 1957, all water samples submitted for routine bacteriologic analysis were mailed to the Air Force hospitals at

Elmendorf or Ladd Air Force Base. The disadvantages of this routine far outweighed the advantages. Experiments performed by Fournelle [3] indicate marked reductions in coliform counts during the long time required for transporting samples from remote areas of Alaska to the laboratory. In addition, many samples were lost by freezing and mishandling in shipment; and there was a time lag of 1 to 3 weeks before results were received by the sampler.

It was necessary to find a method of testing samples that would conform to public health standards [4-6] and that would satisfy the criteria of reliability, reproducibility, rapidity, minimum equipment and training, ease of use, and economy. Based on these criteria the membrane filter kit was chosen as the most likely answer to the problem. The use of membrane filters for examining water samples has received the indorsement of the American Public Health Association and American Water Works Association,[4] as well as the U.S. Public Health Service.[5,6] Several studies of the membrane filter as compared to the most probable number (MPN) method have been published,[7-9] the consensus being that the membrane filter method may be substituted for the latter with benefit.

In April 1957, 15 Sabro water testing kits were provided to the Alaskan Air Command by the surgeon general of the Air Force for distribution to the sites. The Sabro kit provided in one compact unit electric incubator, stainless steel funnel, porous stainless filter holder and gasket, stainless steel receiving flask, and syringe-type vacuum pump and attachments. The filter and dehydrated media are supplied ready for use, in sterilized cans, which are also used for incubation. The membrane filter had been used in the past for field work by sanitary engineers, industrial hygienists, bacteriologists, and sanitarians.[10-13] The assignment of these kits to sites for use by individuals without training in water or laboratory analysis was for the most part a departure from past practice.

The water-testing kits were tried at the 5040th U.S. Air Force Hospital laboratory and the Arctic Health Research Center prior to their issuance to the sites. Personnel of both facilities gave helpful recommendations and comments based on their experiences with site water analyses. A standard operating procedure was developed which covered the entire process from the type and preparation of sampling bottles and reagents, through the sampling, filtering, incubation, and analysis of the sample. The independent duty medical technicians at the sites were instructed in the use of the kit by the Alaskan Air Command sanitary and industrial hygiene engineer or the 11th Air Division sanitarian. Some of the medical technicians, who had received little or no laboratory training, were reluctant to

carry out the tests, but the majority were enthusiastic because of past problems encountered when samples were mailed.

A required minimum of 8 samples per month was established, with an additional sample each month from each area supplied by, but remote from, the main site. Deliberate contamination of an occasional sample was encouraged to insure that personnel would readily recognize coliform colonies. During specified periods, such as when melting snow was used, frequent additional samples were recommended.

A few minor operational problems arose during the first year. The membrane filter assembly used with the kit includes a sterilized membrane filter and dehydrated Endo nutrient pad in a sterilized incubation can. Several reports were received that deliberately contaminated samples had not grown colonies when incubated. At the request of the manufacturer, samples of the membrane filter assemblies on hand were sent to Johns Hopkins University for examination. It was found that the nutrient pads had deteriorated because of excessive moisture and air contact during storage. Under these conditions the sulfite in the Endo-type medium was oxidized and basic fuchsin freed. The presence of this excess dye blocked the formation of a typical Endo reaction and rendered the medium somewhat bacteriostatic, so that positive samples yielded no colonies, colonies without sheen, or colonies too small to be seen. When the problem occurred in the Alaskan Air Command, corrective action to provide moisture protection had already been taken by the manufacturer in the form of improved packaging for the assemblies. No further problem of this type was reported after the assemblies using the new packaging were received. In a few instances the membrane filter unit could not be used because of high seasonal turbidity in surface water, but this has not appreciably reduced the benefit of the units.

Minor mechanical difficulties required stocking of expendable replacement parts. The principle replacement needed was the rubber washer on the side of the vacuum flask, which ruptured on several kits, making it difficult to maintain the vacuum required to pull the water through the filter. The small alcohol burner supplied with the kit is adequate, but a larger laboratory alcohol burner is desirable where greater numbers of samples are tested. The hand syringe used to pull a vacuum on the filter is also rather tedious if a large number of samples must be analyzed.

The membrane filter kits have proved their worth not only by providing routine day-to-day analyses, but also by permitting the running of special tests. In the past, the adequacy of disinfection of new water tanks, piping, or facilities could not be checked by

bacteriologic analyses because of the distance of the sites from the laboratories. Now such items may be checked and results provided within 24 hours. Any compromise of the bacteriologic safety of the water supply or of the storage, treatment, or distribution system can now be immediately monitored, eliminating the need for sometimes unnecessarily severe safety measures pending correction of the condition and receipt of negative results from the laboratory. The presence of the kits at the sites would also permit field tests of water supplies for military and civil defense authorities in time of disaster or war. The use of a different medium permits total bacterial counts of natural waters that are to be used for bathing or for waste disposal.

A tool used by the sanitary engineer and sanitarians during trips into the field is the Millipore monitor membrane kit. A complete kit is composed of metal syringe, syringe valve, graduated measuring cup, sterile disposable plastic tube, and membrane filter, in a sealed plastic container. These are used where the tester does not have a source of electricity for an incubator or where it would be impractical to carry a complete kit.

Standard laboratory membrane filter equipment was obtained in 1958 to permit the preventive medicine unit at the Elmendorf Air Force Base Hospital to test all water samples for bacteriologic purity. The new equipment had the same advantages for the hospital as the kits had for the sites; and had the additional advantages of reduced labor, equipment, space, and material. The other two Alaskan Air Command bases are being encouraged to adopt this method.

SUMMARY

The need for a simple, dependable, and rapid bacteriologic analysis of water at remote Air Force stations in Alaska was successfully met by using the membrane filter method. The Sabro water testing kit, with its individual sterilized membrane assemblies and dehydrated nutrient pads, was the only complete kit tested but was found to be very satisfactory for the remote sites. The Millipore monitor kits have been used for field testing and have also been very satisfactory.

REFERENCES

1. Sanitary Control of Water Supplies for Fixed Installations. Department of the Air Force, Air Force Manual 160–4, 17 Dec. 1957. (Change A, 2 April 1958.)
2. Alter, Amos J.: Arctic Sanitary Engineering. Federal Housing Administration, Washington, D.C., 1950.

3. Fournelle, H. J.: Determining potability of water supplies in field. *U.S. Armed Forces M. J.* 8: 713–717, May 1957.
4. Standard Methods for the Examination of Water, Sewage, and Industrial Wastes. 10th edition. American Public Health Association, Inc., New York, N.Y., 1955, pp. 395–404.
5. Interstate Quarantine Drinking Water Standards. *Federal Register*, 8110, Oct. 23, 1956.
6. Interstate Quarantine Drinking Water Standards. *Federal Register*, 1271, Mar. 1, 1957.
7. Clark, H. F., Geldreich, E. E., Jeter, H. L., and Kabler, P. W.: Membrane filter in sanitary bacteriology. *Pub. Health Rep.* 66: 951–977, July 27, 1951.
8. Thomas, H. A., Jr., Woodward, R. L., and Kabler, P. W.: Use of molecular filter membranes for water potability control. *J. Am. Water Works A.* 48: 1391–1402, Nov. 1956.
9. Jones, T. C.: Use of membrane filter for potable water in Air Force. *U.S. Armed Forces M. J.* 8: 1495–1506, Oct. 1957.
10. Goetz, A.: Basic problems in detection of microbiological air pollution. *Am. Indust. Hyg. A. Quart.* 16: 113–120, June 1955.
11. Geldreich, E. E., Kabler, P. W., Jeter, H. L., and Clark, H. F.: Delayed incubation membrane filter test for coliform bacteria in water. *Am. J. Pub. Health* 45: 1462–1474, Nov. 1955.
12. Eliassen, R.: A realistic appraisal of membrane filters for water quality control. *Water & Sewage Works* 102: 523–524, Dec. 1955.

TV EXPOSURE IN CHILDREN

It is generally agreed the symptoms of headache in children and adults are about the same, with these differences. In children the warning symptoms are loss of appetite, abdominal discomfort, tiredness, instead of hunger and irritability as in adults. The headaches in children at first may be minor and attention to the abdominal distress greater, but the headache increases in severity and gradually the abdominal symptoms subside, perhaps with vomiting. The symptoms in children are usually of shorter duration and the nausea more intense than in adults. The psychogenic element in children seems to be of major importance, the children are usually nervous, show various behavior disturbances such as nail biting, and are of uneven disposition. The attacks are usually brought on by overindulgence in TV showings, little sleep, fatigue, and irregular meals.—Harry R. Litchfield: Headaches in Children. *Archives of Pediatrics*, April 1959.

Electrogoniometric Study of Joints

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EVERETT L. HERDEN, JR., M.S.
MAXIM M. ASA, D.P.E.

THE DEFINITE SUCCESS obtained with a special electrogoniometer [1] designed for measuring the lateral movements of the ankle joint led to the development of a versatile electrogoniometer which was dubbed "universal." [2] This report presents evidence that establishes the validity, reliability, and objectivity of the instrument, and shows how it can be used and what information can be obtained.

MATERIALS AND METHODS

The universal electrogoniometer is basically the same as the ankle electrogoniometer reported on previously.[1] The main difference lies in the accessories by means of which the instrument is attached to the body.

The electrogoniometer (fig. 1) consists essentially of a small, round potentiometer with two shafts of various lengths, one attached to the housing of the potentiometer and the other to the knob. The length of the shafts depends on the size of the body segments forming the joint. The potentiometer is approximately ¼ inch thick, ½ of an inch in diameter, and has 0 to 10,000 ohms of resistance.

The present goniometer is calibrated and operated in the same manner as the ankle electrogoniometer, although to expedite the calibration a much larger protractor was used in the present study (12 inches in diameter instead of 10). Also, in addition to the Sanborn, Model No. 150, oscillograph, an 8-channel Visicorder, Model No. 906, was used. Since this is a portable instrument, it can be easily taken out of the laboratory.

From Department of Physiology, Springfield College, Springfield, Mass. This work was supported by a grant from the Research and Development Division, Office of the Surgeon General, Department of the Army, Washington, D.C.

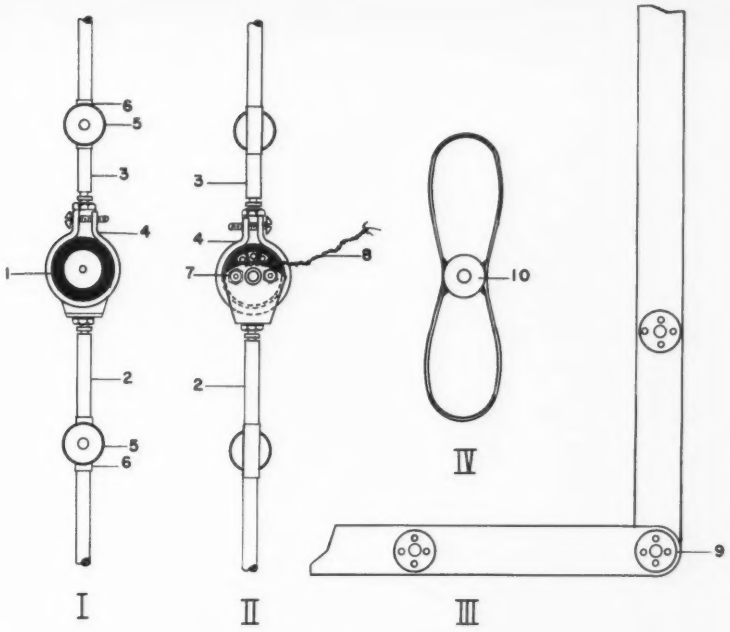

Figure 1. Electrogoniometer. (I) Rear view. (II) Front view. (1) Potentiometer with a stud of the snap fastener in the middle. (2) and (3) Brass tubular shafts. (4) Clamp for attaching shaft (3) to the housing. (5) Studs of the snap fasteners, mounted on sleeves (6). (7) Plate for attachment of the shaft (2) to the knob of the potentiometer. (8) Wires for connecting with a battery and meter or oscillograph. (III) Chassis. (9) Joint between the 2 parts of the chassis with a socket for the stud fastener. (IV) Butterfly holder, with a snap fastener (10) in the middle.

The electrogoniometer is placed so that the center of the potentiometer is directly over the center of rotation of the joint involved, and the two shafts are over the articulating bones. This is accomplished with the aid of a chassis (fig. 2) consisting of two strips of brass, ½ inch wide and 8 inches long, joined together at one end so as to be freely movable around a rivet. The chassis is attached to the skin with adhesive tape. The goniometer is secured to the chassis by means of 5 snap fasteners. The socket parts are soldered to the chassis: one is placed over the joint connecting the two halves and the others on the chassis arms. The studs of these snap fasteners are attached to the goniometer: one to the center of the housing, the

others to the shafts. To attach the electrogoniometer to the chassis, the operator merely has to press the studs into the sockets. Thus, if several subjects are to be tested, the operator should have several chassis but needs only one goniometer, transferring it from subject to subject.

For an instantaneous reading of goniometric measures, a new, larger meter made from a microammeter was designed and built. Figures 3 and 4 show the details of wiring and the calibrating protractor.

For the purpose of calibration (fig. 4), the electrogoniometer is secured to a protractor by means of two snap fasteners so that one

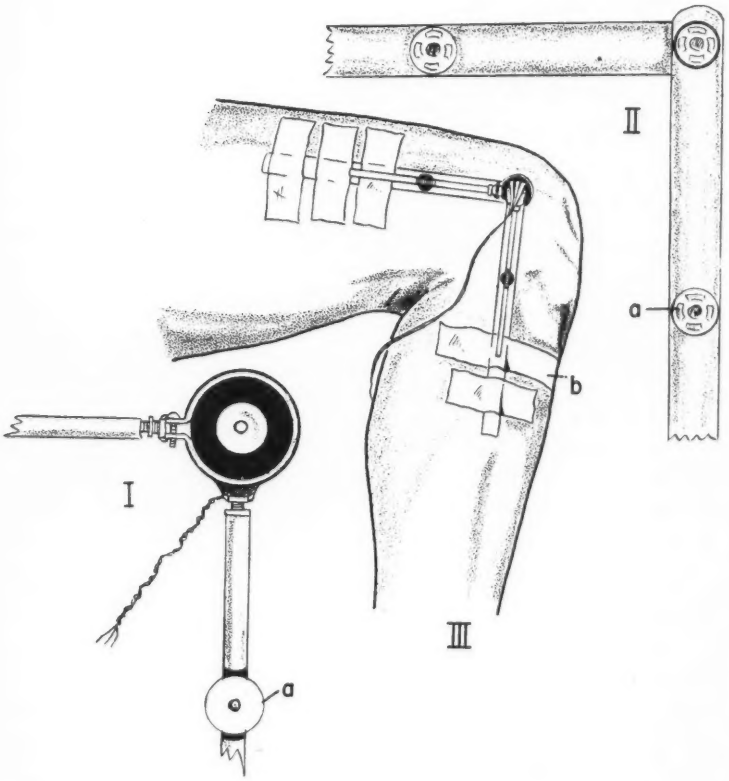

Figure 2. Electrogoniometer on the knee joint. (I) Goniometer. (II) Chassis. (III) Chassis and goniometer placed on the knee. (a) Snap fasteners. (b) Adhesive tape.

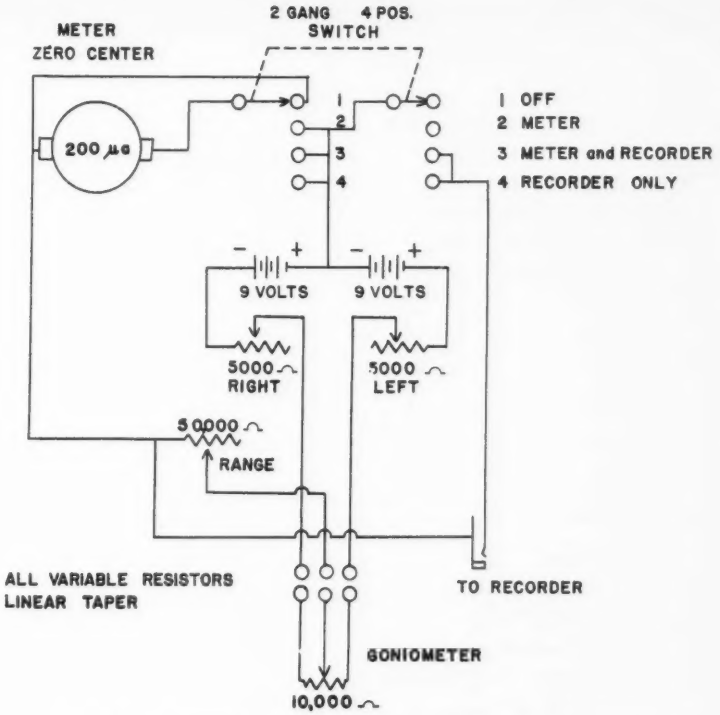

Figure 3. Diagram of a meter used with an electrogoniometer.

shaft becomes immobilized. A transparent plastic extension, with a hairline drawn through the middle, is attached to the movable shaft to aid in calibration.

The electrogoniometer is connected by wire to a meter, which in turn is connected with an oscillograph. In using the Sanborn oscillograph, calibration of the electrogoniometer must first be obtained on the meter and then calibrated on the oscillograph paper. After obtaining electric balance of the meter, it is possible, with a Visicorder, to calibrate the electrogoniometer directly on the oscillograph paper.

The steel rods used in this study (fig. 5) were 12 inches long and 0.025 inch in diameter. Three flat brass pieces, 1½ inches long and ½ an inch wide, were soldered across each rod, 3 inches apart starting at one end of the rod. These crosspieces are used for attaching the

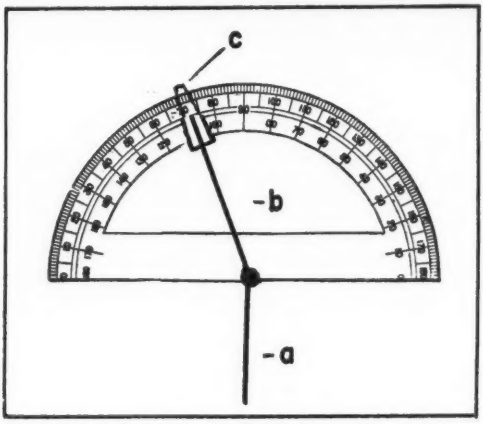

Figure 4. Electrogoniometer attached to a protractor for calibration. (a) Immobilized shaft. (b) Movable shaft with a transparent point (c) attached for calibration.

rods to the skin with adhesive tape. The rods are placed on the midline of the limb so that they overlap each other about 5 inches over the joint. The strips of adhesive tape are placed across the crosspieces to secure them to the skin.

The manual goniometer used in this study was of metal, with arms 14 inches long and from ½ to ¾ inch wide. Measurements were obtained with this instrument by placing it over the midline of the bones forming the joint.

ELBOW JOINT

Since the electrogoniometer is attached to a chassis with a fixed point of rotation while joints in general have either a slightly changeable or greatly changeable axis of rotation, the question arose whether the electrogoniometer indicates the true angles assumed by the limbs forming a joint. To answer this question it was decided to test the goniometer against the measurements obtained by 2 rods attached to the opposite sides of the joint. The point of intersection of these rods could move freely and follow the movement of the axis of rotation in the joint, thus, apparently, indicating the true angle formed by the limbs.

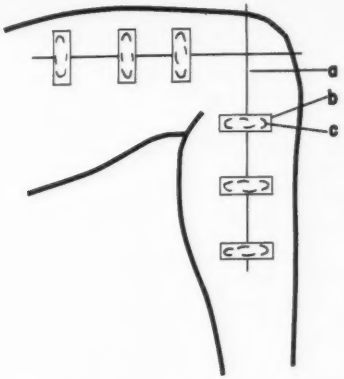

Figure 5. Rods (a) attached to a leg for measuring the knee angle. (b) Adhesive tape. (c) Metal cross-pieces under the tape.

In arm marking, the subject stood upright, his arm flexed at the elbow at 90° with a fully supinated hand. The superior surface of the acromion, the lateral epicondyle of the humerus, and the styloid process of the radius were found and marked. A line extending from the shoulder to the wrist was drawn with a ruler through these points. The lateral epicondyle was then marked as the center of rotation (projection of the axis of rotation on the lateral side). The superior point of the medial epicondyle of the humerus was also found and marked as the medial center of rotation of the elbow joint (projection of the axis of rotation on the medial side). A straight line was drawn from this center point to the styloid process of the ulna, and was extended approximately 8 inches toward the axilla.

To attach the electrogoniometer to the elbow joint, the operator placed the chassis over the marked line in such a way that the connecting rivet of the chassis was directly over the marked center point of rotation at the joint (lateral epicondyle of the humerus), and the midlines of the shafts were over the marked lines above and below the joint. The chassis was then secured to the skin with adhesive tape. After a short test for proper fixation, which was accomplished by asking the subject to flex and extend his arm several times, the precalibrated electrogoniometer was then snapped over the chassis in such a way that the central stud of the housing was placed over the central rivet, and the shafts were snapped over the arms of the chassis.

The operator taped the 2 steel rods over the medial line above and below the joint, allowing each rod to extend 5 inches beyond the center of rotation and to overlap the other in a straight line. The subject was then asked to flex and extend his elbow several times. The fact that the rods remained over the midlines and intersected freely over the center point proved them to be adjusted properly, and ready for the testing.

To measure the elbow angles the subject was seated alongside a table, with his arm resting on the adjacent table. His arm was flexed at the elbow and supported at various positions throughout the range of motion, by an adjustable cross bar attached to a stand. Readings were taken simultaneously by 2 independent observers and recorded separately.

Results

Figure 6 shows that there was very little difference between the measurements obtained on the elbow joint with the 2 instruments. The average difference for all 16 subjects was $\pm 1°$ in all testing positions, except in those between 171° and 180°, where the difference

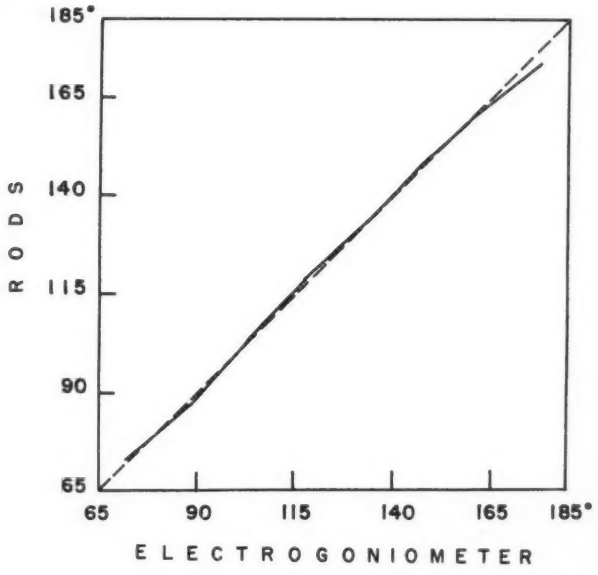

Figure 6. Comparisons of the elbow angle measurements obtained with an electrogoniometer and with 2 rods.

was +3.60°. Statistical analysis showed that the coefficient of correlation between the data obtained with both instruments was 0.99.

KNEE JOINT

The electrogoniometer was placed on the lateral side so that its center fell on the lateral epicondyle of the femur, its shafts on the lines connecting with the midpoint of the greater trochanter and the midpoint of the lateral malleolus. The steel rods were placed on the midline of the medial side of the leg.

To measure the knee angles, the subject was placed in a prone position. His leg was flexed at the knee and supported at various positions throughout the range of motion by the same crossbar used for the elbow joint. Simultaneous readings of angles formed by the goniometer and the steel rods were taken by 2 independent observers. Seven subjects with normal knees were used.

Results

From figure 7 one may see that the results obtained with both instruments are very close. The average difference was ±1.5°, except between 171° and 180°, when the difference was +4.66°.

COMPARISON OF KNEE ANGLE MEASUREMENTS

After obtaining evidence of the validity of measurements made with the electrogoniometer, it was decided to compare them not only with those obtained with the rods but also with those made with a manual goniometer. Moreover, it was also necessary to test the reliability and objectivity of all 3 instruments. Since the knee joint has a migrating axis of rotation and since obtaining accurate data is therefore more difficult, it was decided to use the knee joint for this purpose.

Fifteen men, all inmates in the Hampden County Jail, were volunteer subjects, selected for this study by the assistant county sheriff, with the provision that all men included have no abnormalities of the knee joint. The selected candidates were further examined by the experimenters. Only one man had to be dismissed, because of bowleggedness.

In order to avoid difficulties involved in obtaining a 180° angle, the leg marking was done in a somewhat different manner from that used for the validation. The subject was placed in a standing position with feet parallel and approximately 8 inches apart. In this

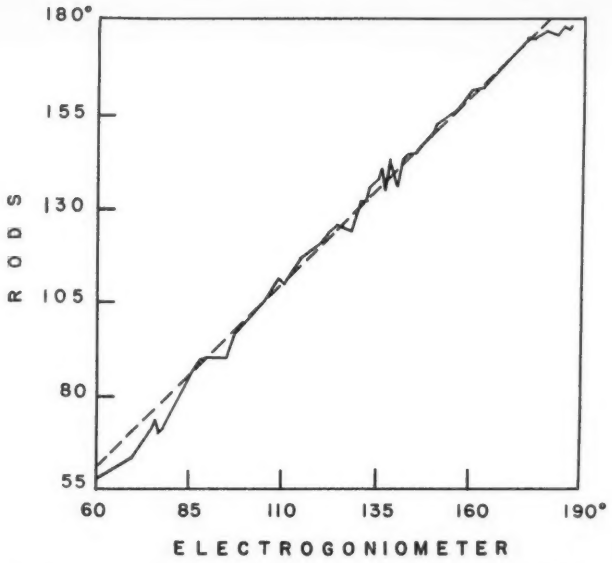

Figure 7. Comparison of the knee angle measurements obtained with an electrogoniometer and with 2 rods.

position the lower border of the patella was palpated and then marked with a ball-point pen. Next, a line parallel to the floor was drawn across the lateral side of the knee joint at the level of the patellar marking. The patellopopliteal distance was measured with a breadth caliper and the midpoint was marked on the skin. A straight line was then drawn from the posterior border of the lateral malleolus through this midpoint and extending approximately 10 inches up the thigh.

This system of marking was used on each of the 15 subjects, and one tester marked the legs of 8 men while the second tester marked the remaining 7. After the first testing session for one subject was completed, the leg line was washed off, but the center point was indicated with India ink. A piece of tape was placed over the mark to preserve it for the following day. When the subject returned for his second round of testing, the leg line was drawn by the experimenter who had originally marked the leg. The electrogoniometer and the 2 other instruments were always placed on the lateral side of the leg.

The 9 knee positions selected for testing were from 90° to 170° in 10° intervals. The subject was seated on a special bench and his leg

was strapped to a supporting frame attached to the bench, so that the frame could swing forward and up (fig. 8). At the upper end of this frame, a pointer indicated on a protractor the angle made by the frame and the seat. A cord was attached to the lower end of the frame and to a winch so that the supporting frame could be raised and fixed at any desired position. In attempting to prevent the subject from leaning and shifting the body, he was asked to grasp the sides of the bench with both hands at marked places.

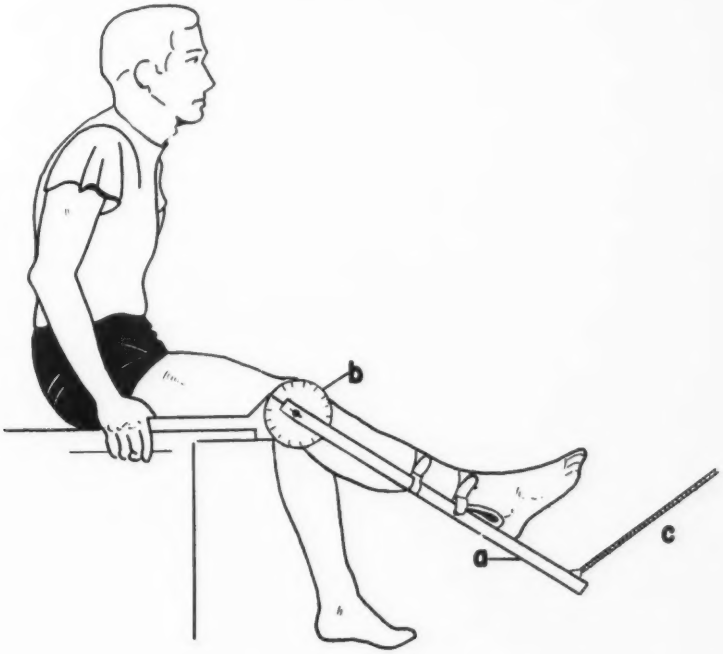

Figure 8. Device for stabilization of the knee position. (a) Frame that can swing up and down. (b) Protractor indicating the angle formed by the frame and the seat. (c) Cord leading to a winch.

With each of the 3 instruments, 2 operators tested each subject twice on 2 different days. Thus, 4 measurements were made at each of the 9 knee positions on each subject, making a total of 540 tests.

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Results

Figure 9 is based on the findings in 540 tests. The curves representing the average data obtained with each instrument lie close at the upper right corner. They should have been closer because the initial position of all instruments was 180°. The manual goniometer consistently gave lower figures than the electrogoniometer. The rods gave the highest scores during the first 5 positions of the knee, after which the scores became lower than those obtained with the electrogoniometer.

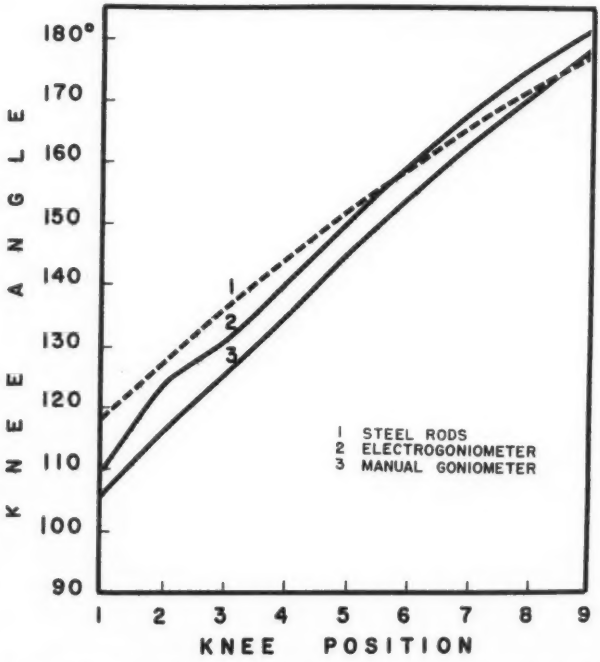


Figure 9. Comparison of the knee angle measurements obtained, in a total of 540 tests, with 3 instruments: manual goniometer, electrogoniometer, and 2 rods. The subject sat on a special seat and the knee was secured by a supporting device at 9 different positions.

Statistical analysis (table 1) showed that, with few exceptions (indicated in the table), there was a statistically significant difference between the measurements obtained with the 3 instruments. Since the measurements obtained by the electrogoniometer lie between those

obtained with the other two instruments, it seems logical to make them acceptable as the measure of the "true angle." For angle measurements during motion, there is no other choice but the electrogoniometer.

Table 1. ***Comparison of measurements of the knee angles obtained with the manual goniometer, electrogoniometer, and steel rods on 15 subjects***

Knee† position	*Manual goniometer* ($M_1+M_2+M_3+M_4$)	*Electrogoniometer* ($M_1+M_2+M_3+M_4$)	*Steel rods* ($M_1+M_2+M_3+M_4$)
1	423.27	439.47	474.47
2	461.33	478.93	509.73
3	500.20	520.47	543.07
4	539.53	560.20	574.94
5	579.07	599.20	606.60
6	615.73	636.27	635.00
7	647.80	670.33	660.54
8	679.73	698.53	685.00
9	709.53	722.74	708.40

†Angle formed by the seat and leg support.

Means:

M_1=Tester A on first test.
M_2=Tester A on retest.
M_3=Tester B on first test.
M_4=Tester B on retest.

Note: Any 2 means *not* underscored by the same line are significantly different from each other at either the 5 percent or 1 percent level.

Tables 2 and 3 give the test and retest data used to check the reliability of the measurements. With a few exceptions, the differences obtained during the test and retest were not statistically significant. Even when the differences were significant they ranged only from 1.46° to 2.40°, which is not much when angles over 100° are measured. For this reason, it must be concluded that the 3 instruments, when properly used, are reliable.

The data used for objectivity tests are given in tables 4 and 5. It may be seen that measurements obtained by 2 different testers may give statistically significant differences. This is especially true for the manual goniometer, with which it occurred for as many as 8 out of 9 positions. The incidence of statistical significance of difference for steel rods was less, and for the electrogoniometer still less. As a matter of fact, this significance occurred only three times for M_4–M_2, twice for M_3–M_1, and completely disappeared when M_4–M_1 were com-

Table 2. ***Means of knee angles obtained by 2 testers using the manual goniometer, electrogoniometer, and steel rods on 15 subjects***

Knee† position	*Manual goniometer*				*Electrogoniometer*				*Steel rods*			
	Tester A		*Tester B*		*Tester A*		*Tester B*		*Tester A*		*Tester B*	
	$T_1°$	$T_2°$	$T_1°$	$T_2°$	$T_1°$	$T_2°$	$T_1°$	$T_2°$	$T_1°$	$T_2°$	$T_1°$	$T_2°$
1	103.40	102.93	109.20	107.73	109.53	108.73	110.67	110.53	119.07	118.07	118.40	118.93
2	113.20	112.33	118.80	117.00	119.53	118.73	120.33	120.33	128.00	126.07	127.93	127.73
3	123.07	122.60	128.47	126.07	129.87	129.27	130.60	130.80	135.93	133.73	137.00	136.40
4	132.73	132.87	137.80	136.13	139.93	139.13	140.67	140.47	142.67	141.87	145.67	144.73
5	143.53	142.73	147.13	145.67	149.67	148.87	150.53	150.13	150.87	149.73	153.33	152.67
6	152.73	152.13	155.73	155.13	159.13	157.60	160.20	159.47	157.40	157.07	160.33	160.20
7	160.80	160.87	163.47	162.67	167.47	166.47	168.73	167.67	163.60	164.07	166.87	166.00
8	169.80	168.73	170.87	170.33	174.33	173.53	175.67	175.00	170.20	170.60	172.53	171.67
9	177.33	176.80	177.73	177.67	180.60	179.47	182.07	180.60	176.67	176.60	177.60	177.53

†Angle formed by the seat and leg support.
T_1=First test.
T_2=Retest.

Table 3. ***Reliability test of the manual goniometer, electrogoniometer, and steel rods in measuring knee joint angles on 15 subjects***

Knee† position	Manual goniometer				Electrogoniometer				Steel rods			
	M_1-M_2		M_3-M_4		M_1-M_2		M_3-M_4		M_1-M_2		M_3-M_4	
	Diff.°	r	Diff.°	r	Diff.°	r	Diff.°	r	Diff.°	r	Diff.°	r
1	.47	.56	1.47	−.06	.80	.70	.14	.68	1.00	.37	−.53	.42
2	.87	.49	1.80++	.04	.80	.67	.00	.72	1.93+	.33	.20	.32
3	.47	.23	2.40*	−.09	.60	.62	−.20	.77	2.20++	.00	.60	.54
4	−.14	.35	1.67	.14	.80	.66	.20	.64	.80	−.09	.94	.44
5	.80	.55	1.46++	.25	.80	.66	.40	.65	1.14	.17	.66	.57
6	.60	.54	.60	.02	1.53+	.58	.73	.46	.33	.08	.13	.67
7	−.07	.47	.80	.06	1.00	.49	1.06	.52	−.47	−.05	.87	.38
8	1.07	.32	.54	−.33	.80	.46	.67	.31	−.40	.29	.86	.56
9	.53	.62	.06	.08	1.13	.20	1.47+	.41	.07	.66	.07	.36

†Angle formed by the seat and leg support.
*Significant at the 5 percent level.
+Significant at the 20 percent level.
++Significant at the 10 percent level.
Diff. = Difference between means in degrees.
r = Coefficient of correlation.

Means:
M_1 = Tester A on first test.
M_2 = Tester A on retest.
M_3 = Tester B on first test.
M_4 = Tester B on retest.

pared. Thus, the electrogoniometer had the highest degree of objectivity.

When the sums of both tests, made by one tester, were compared with the sums of both tests made by the second tester, the significance of the difference disappeared, even at the 20 percent level (table 5).

TESTS ON THE CADAVER

Because of certain changes in the shape of limbs caused by muscles, not only during active but also during passive movements, and because of a certain amount of skin displacement during these movements, it was decided to test the goniometer on cadavers. Originally, it was planned to test the electrogoniometer against 2 steel rods attached along the midline of the thigh and the lower leg. On one leg these rods were to be attached to the skin by adhesive tape; on the other leg they were to be attached to metal pins inserted into the tibia and femur (two pins in each bone). The goniometers were to be attached in the usual manner. It was readily found that, because of absence of muscle tone, attachment of the instruments to the skin by adhesive tape became impractical. For this reason, rods were attached only to the pins and the goniometers were secured by means of strips of tape placed around the limb.

Table 4. ***Objectivity test of the manual goniometer, electrogoniometer, and steel rods in measuring knee joint angles on 15 subjects***

Knee† position	*Manual goniometer*								*Electrogoniometer*								*Steel rods*							
	M_3–M_1		M_4–M_1		M_3–M_2		M_4–M_2		M_3–M_1		M_4–M_1		M_3–M_2		M_4–M_2		M_3–M_1		M_4–M_1		M_3–M_2		M_4–M_2	
	Diff. °	*r*	*Diff.* °	*r*	*Diff.* °	*r*	*Diff.* °	*r*	*Diff.*°	*r*	*Diff.*°	*r*	*Diff.*°	*r*	*Diff.*°	*r*	*Diff.* °	*r*	*Diff.* °	*r*	*Diff.* °	*r*	*Diff.*°	*r*
1	5.80**	−.01	4.33**	−.09	6.27**	.34	4.80**	.23	1.14	.70	1.00	.65	1.94+	.68	1.80+	.67	−.67	.51	−.14	.14	.33	.48	.86	.73
2	5.60**	.09	3.80**	.04	6.47**	.32	4.67**	.10	.80	.65	.80	.60	1.60	.71	1.60	.73	−.07	.56	−.27	.25	1.86+	.43	1.66+	.56
3	5.40**	.12	3.00*	.50	5.87**	.48	3.47**	.20	.73	.67	.93	.65	1.33	.70	1.53	.74	1.07	.39	.47	.21	3.27*	.11	2.67*	.42
4	5.07**	.51	3.40**	.42	4.93**	.30	3.26**	.23	.74	.59	.54	.62	1.54+	.76	1.34	.70	3.00*	.36	2.06+	.57	3.80*	−.08	2.86*	.30
5	3.60**	.74	2.14**	.34	4.40**	.38	2.94**	.09	.86	.50	.46	.53	1.66+	.71	1.26	.63	2.46*	.30	1.80+	.60	3.60**	.16	2.94*	.35
6	3.00**	.31	2.40**	.40	3.60**	.26	3.00**	.03	1.07	.31	.34	.37	2.60*	.48	1.87+	.66	2.93*	.24	2.80*	.50	3.26*	.42	3.13*	.42
7	2.67**	.65	1.87*	.46	2.60**	.38	1.80*	.03	1.26	.34	.20	.29	2.26*	.43	1.20	.64	3.27*	.10	2.40*	.30	2.80*	.11	1.93+	.52
8	1.07	−.32	.53	.20	2.14*	.02	1.60++	.04	1.34+	.37	.67	.30	2.14*	.12	1.47+	.72	2.33*	.46	1.47++	.44	1.93*	.10	1.07	.51
9	.40	−.04	.34	.48	.93	−.30	.87	.63	1.47+	.16	.00	.18	2.60*	.05	1.13	.57	.93+	.48	.86+	.67	1.00+	.22	.93+	.48

†Angle formed by the seat and leg support.
*Significant at the 5 percent level.
**Significant at the 1 percent level.
+Significant at the 20 percent level.
++Significant at the 10 percent level.

Diff. = Difference between means in degrees.
r = Coefficient of correlation.

Means:
M_1 = Tester A on first test.
M_2 = Tester A on retest.
M_3 = Tester B on first test.
M_4 = Tester B on retest.

Table 5. ***Objectivity test based on sums:*** (M_1+M_2) ***and*** (M_3+M_4)

Knee position	1	2	3	4	5	6	7	8	9
	r	r	r	r	r	r	r	r	r
Manual goniometer	.22	.10	.61	.54	.58	.39	.57	−.02	.31
Electrogoniometer	.79	.81	.82	.81	.70	.60	.55	.60	.42
Steel rods	.67	.64	.46	.44	.51	.59	.45	.53	.58

Although tests on one cadaver indicated closeness of measurements obtained with both types of instruments, the comparative tests on living subjects gave much closer figures. This may be attributed to the technical difficulties of drilling holes in the bones so that the pins would be perpendicular to the plane of the axis of rotation of the knee. It was thought that further tests on cadavers would not furnish any better evidence of the validity of the electrogoniometric measurements, and therefore these tests were discontinued.

KNEE ACTION DURING ACTIVITY

Six activities were selected to illustrate the type of records of knee action (knee goniograms) which can be obtained with the electrogoniometer. A portable oscillograph, the Visicorder, was used.

Trunk forward bend and squat. The record (fig. 10, I) is self explanatory. It may be seen that during the trunk bend (a), the legs were straight; yet when the man assumed an erect position (b), the knees became slightly bent.

Knee bend in prone position. This exercise was done by a subject who lay on the table, face down with knees extending beyond the edge of the table and the lower legs flexed to a 90° angle (fig. 10, II). When the subject brought his lower legs from the vertical position to the horizontal position (a), the knees became hyperextended.

Stepping up and down on a bench. The electrogoniometer was attached to the right leg (indicated by a solid line in figure 10, III). It is easy to see that although the subject was supposed to stand straight on the bench in (a), his legs were bent about 20° (160°). When he stepped on the floor in (b), the leg still was not straight (168°); and there was a shock-absorbing action of the knee in (c) which caused a knee bend to 140°.

Walking. The goniometer was attached to the right leg (indicated by a solid line in figure 11, I). It is easy to see that the maximum knee bend was about 55° and the shock-absorbing action of the knee in (a) was about 5°.

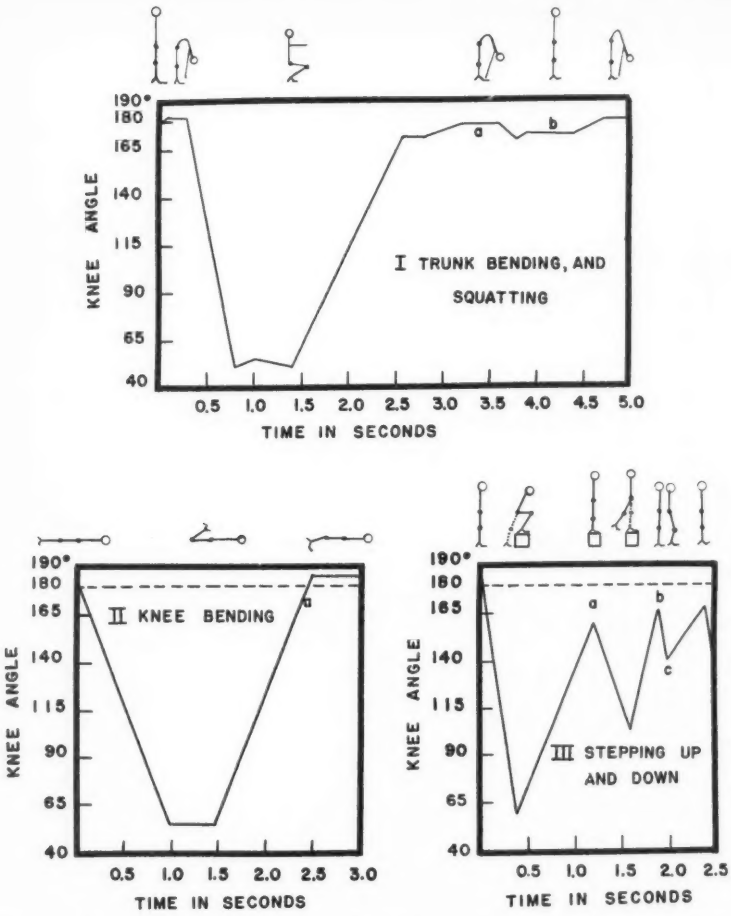


Figure 10. Electrogoniometric records of knee angle changes during certain activities. (The tested leg is indicated by solid lines.) (I) Trunk forward bending, and squatting. (a) Legs are straight. (b) Knees are bent although they were assumed to be straight. (II) Knee bend in prone position. (a) Hyperextension. (III) Stepping up and down. Legs are not straight in (a) and (b). (c) Shock-absorbing knee bend.

Slow running. In running (fig. 11, II), the knee bend was much greater than in walking. The shock-absorbing action at (a) was about 10°.

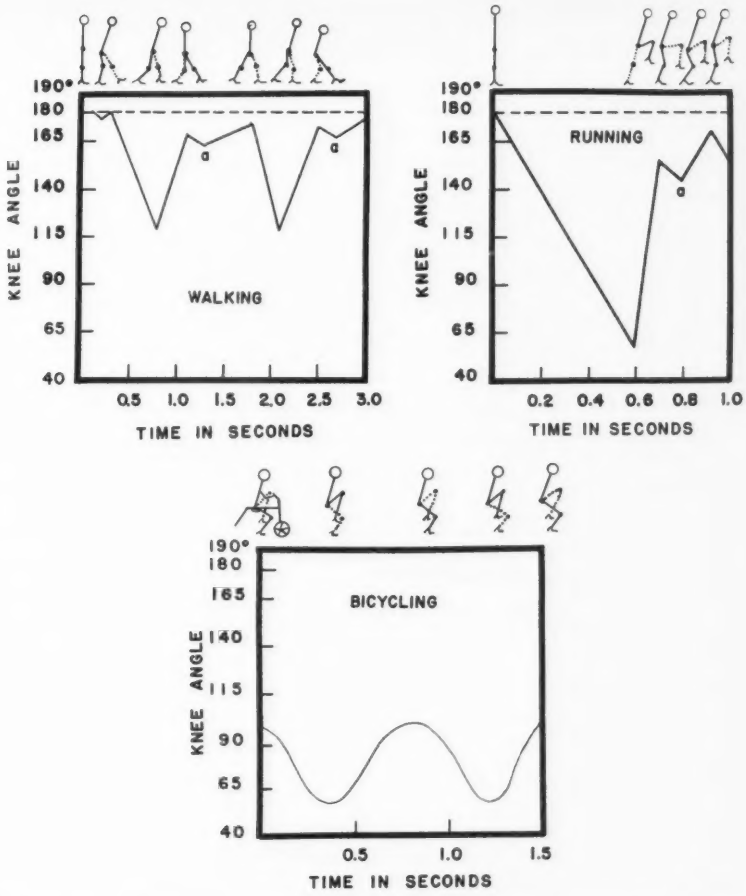


Figure 11. Electrogoniometric records of knee angle changes in certain activities. (The tested leg is indicated by solid lines.) (I) Walking. (a) Knee bend for shock absorbing. (II) Slow running. (a) Knee bend for shock absorbing. (III) Bicycling.

Riding a stationary bicycle. The right leg (indicated by a solid line in figure 11, III) was used. The record represents a smooth sinusoidal curve with an amplitude of about 40°. (The electrogoniometer is so easy to use that it may become of value in the study of body movements in industry.)

Knee action records obtained on artificial and paralyzed legs. The records obtained on a normal leg and on an artificial leg attached above the knee while the subject changed from a standing to a sitting position look identical (fig. 12); however, during walking the records are different. The amount of knee flexion during elevation of the thigh is less in the prosthetic leg than in the normal. The shock-absorbing flexion of the knee is practically absent in the prosthetic leg.

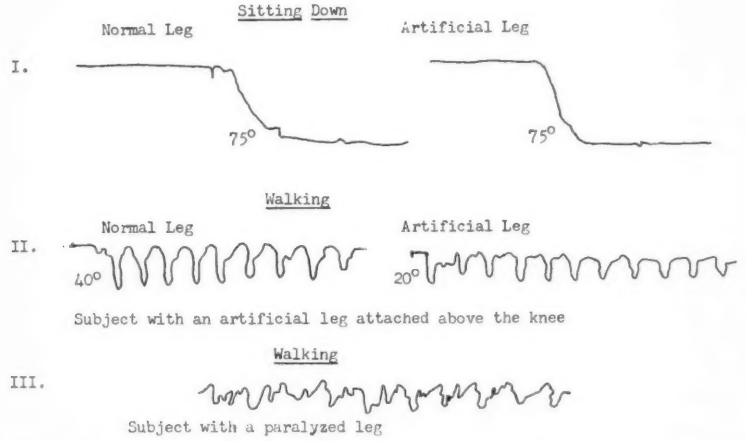


Figure 12. Electrogoniograms of the knee joint obtained on normal, artificial, and paralyzed legs.

The knee action of the paralyzed leg follows the general pattern, but lacks stability, as indicated by the wavelike character of the lines.

THE CENTER FINDER

The center finder is an instrument designed to determine the location of the axis of rotation of a joint. It can be used whether the axis of the joint is fixed, as in the elbow, or shifting, as in the knee joint.

Because it actually determines the projection of the axis on a plane perpendicular to the axis, the instrument has been called a "center finder" instead of an "axis finder," and in this report the word "center" will be frequently used instead of "axis."

Use of the center finder involves the utilization of a simple geometric theorem: if 2 arcs of a circle are given, the center of the circle will be found at the intersection of the perpendiculars erected at the midpoints of the 2 cords drawn through these arcs. In the case of a

migrating axis of rotation this process has to be repeated through consecutive parts of the range of motion of the joint.

The center finder (fig. 13) consists of 2 separate parts: the writing part carrying a stylus, and the recording part carrying a piece of special paper, that used on the Sanborn inkless metabolism apparatus. By means of a simple mechanism, the stylus can be moved either nearer to or farther from the main shaft. It can also be moved to the left or right, up or down, and adjusted so that it will always be perpendicular to the surface of the recording paper. The pressure of the stylus on the paper is regulated by means of a spring.

The writing arm is usually attached to the movable limb, the recording arm to the stationary limb. (Strictly speaking, it probably is impossible to make a body segment completely stationary when another segment attached to it is moving. The mere contraction of the muscles around the "stationary" segment usually causes a certain amount of displacement. The best that can be done is to reduce this displacement to a minimum.) When both segments forming a joint are moving, however, the record obtained is obviously a result of a combination of simultaneous movements of both segments.

The shafts of both parts of the center finder described here have a pair of "butterfly" crosspieces soldered to movable sleeves with set screws (fig. 13). Strips of adhesive tape placed across these crosspieces will hold them securely on the skin. The shafts are placed along the approximate midlines of the limbs, although obviously it is not important that this positioning be exact because the arms merely support the stylus and the paper. The only important requirement is that the stylus shall never lose contact with the paper.

With the center finder in place, the subject is asked to make a movement in the joint being tested, so that an arc is described on the paper. After this, the stylus is moved to another point and the subject makes another movement. With the aid of these 2 arcs the center of rotation is found. Usually this procedure is repeated at least once for the sake of accuracy.

As has been mentioned before, on a joint with a "migrating" axis of rotation, the location of the center should be determined for a series of movements in the joint. If the stylus is placed on one of these centers and the subject is asked to perform a complete movement in the joint, the stylus will describe a curvilinear path approximating changes in the location of the axis of rotation of the joint.

Unless it is a geometrically perfect hinge or of the ball-and-socket type, the position of the center of rotation in a joint varies depending on whether both bones forming the joint are moving simultane-

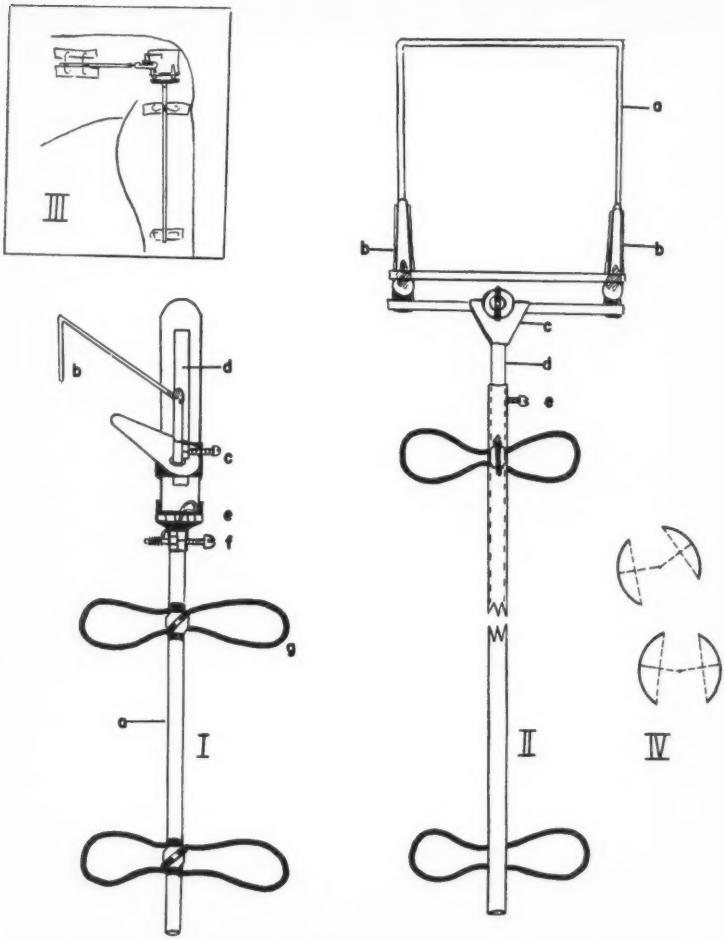


Figure 13. Center finder. (I) Writing part. (a) Shaft made of a brass tube. (b) Stylus. (c) Mechanism for moving the stylus in the slot (d) or to the side. (e) The spring pressing stylus against the paper. (f) Hinge to allow up-and-down movement. (g) "Butterfly" wire loops. (II) Recording part. (a) Frame for supporting the paper. (b) Clamp to hold the paper. (c) Joint and a set screw to control position of the frame. (To reinforce the paper, a piece of thin cardboard is placed under the paper on the frame.) (d) Telescopic extension. (e) Set screw. (III) Center finder attached to the knee. (IV) Locating single and migrating centers.

ously, or one is moving and the other stationary.[3] In the latter case it is important to know which is moving and which is stationary.

Migration of the axis of rotation. In order to demonstrate a technic for tracing the migration of the axis of rotation, the knee was chosen, because, besides rotating in a sagittal plane, this joint has a certain amount of gliding displacement. Obviously, all 3 combinations of bone motion were explored: (a) femur stationary-tibia moving, (b) tibia stationary-femur moving, and (c) both bones moving simultaneously.

Although the stylus part of the center finder is supposed to be attached to the moving limb, and the part carrying the paper is attached to the stationary limb, a reversed position of the stylus and paper also was used in order to demonstrate a difference in records caused by this reversal of position. A description of methods of determining the center of rotation and of some of the records obtained on one subject is given below. In every instance the center finder was placed on the lateral side of the leg.

Method I. Tibia moves, femur is stationary. The subject sat on a table with knees just over the edge of the table. The right leg was completely extended and the center finder was placed on that leg so that the stylus was attached to the tibia, the paper to the femur. The subject was then asked to move his lower leg approximately 20° (from 180° to 160°), and the center of rotation was found and marked on the skin with a ball-point pen.

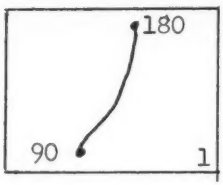
Method II. Femur moves, tibia is stationary. The subject stood with feet parallel, 8 inches apart. A crossbar clamped to a stand was placed just below the patella on each leg. The subject was then asked to flex his legs (about 20°) without losing contact with the bar. The stylus was placed on the femur, the paper on the tibia.

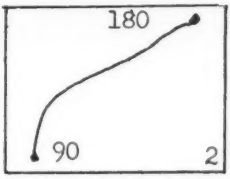
Method III. Tibia and femur move simultaneously. The subject sat on a stationary bicycle with feet strapped to the pedals. Beginning with the leg extended as much as the pedal would allow, the center of rotation was determined for a quarter of a pedal revolution. The stylus was placed on the femur, the paper on the tibia.

Obviously, during natural locomotion, both the femur and the tibia move. Moreover, the relative extent of motion of the bones varies. For example, in walking, during the knee lift the femur rotates considerably while the tibia is relatively stationary. During knee extension the "rotary" action of the tibia is greater than that of the femur.

Thus, behavior of the bones should be kept in mind when utilizing a center of rotation determined during one type of condition (methods I, II, and III) to a motion which involves a different type of condi-

a



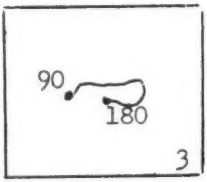


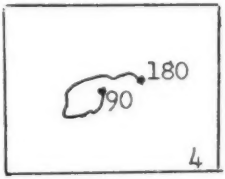
Paper on Femur Paper on Tibia

K N E E B E N D

Tibia Moves

b



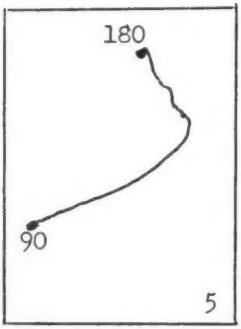


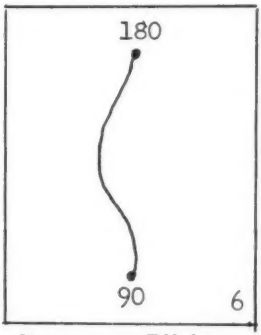
Paper on Femur Paper on Tibia

K N E E B E N D

Femur Moves

c





Paper on Femur Paper on Tibia

K N E E B E N D

Tibia and Femur Move

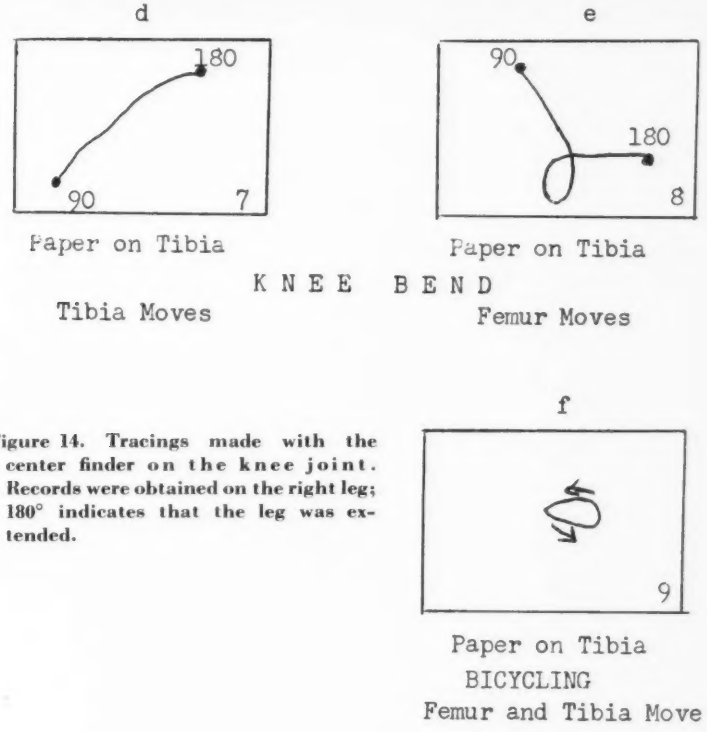


Figure 14. Tracings made with the center finder on the knee joint. Records were obtained on the right leg; 180° indicates that the leg was extended.

tion. Figure 14 illustrates this statement. In a, b, and c, the center was determined by method I (tibia moves, femur is stationary). Then, with the leg in complete extension, the stylus was placed over the center mark, and the subject was asked to flex his leg to 90° while sitting on the edge of the table (1 and 2); standing and bending knees with tibia fixed by a crossbar (3 and 4); and standing and bending knees in the natural way (5 and 6).

In figure 14 d, e, and f, the center was determined by method III (tibia and femur move simultaneously). With the stylus placed over the center mark, tracings were obtained for 90° of leg flexion while sitting on the edge of a table (7); standing and bending knees with the tibia fixed by a crossbar (8); and sitting on a stationary bicycle and executing one complete pedal revolution (9).

Roentgenographic observations of skin displacement. It is easy to

observe that the skin covering the knee joint is displaced during movements of the joint; therefore, skin marks over a bony landmark during one position of the leg do not necessarily indicate the location of this landmark when the position of the leg has been changed.

In order to obtain information regarding the effect of the movement in the knee joint upon the relative position of skin marks and the bones, roentgenograms were made. The center of rotation was determined with the aid of the center finder, and the point marked on the knee joint with the leg completely extended. A small metal nut was then glued directly over this mark. Two steel rods were also taped to the midline of the subject's leg so they would intersect over the nut when the leg was in a position of approximately 170°. Roentgenograms were taken at positions of approximately 170°, 135°, and 90°. Inspection of these, as illustrated diagrammatically in figure 15, clearly showed the displacement of the nut caused by the skin movement on the lateral side of the knee joint. It was also observed that the intersection of the two rods migrated during the leg flexion, and that this migration was independent of the movement of the nut. The roentgenograms also showed that the relative position of the bones and the rods changed during the knee movement. These observations indicate that the skin mark of the center of rotation is valid only within the range of motion during which the location

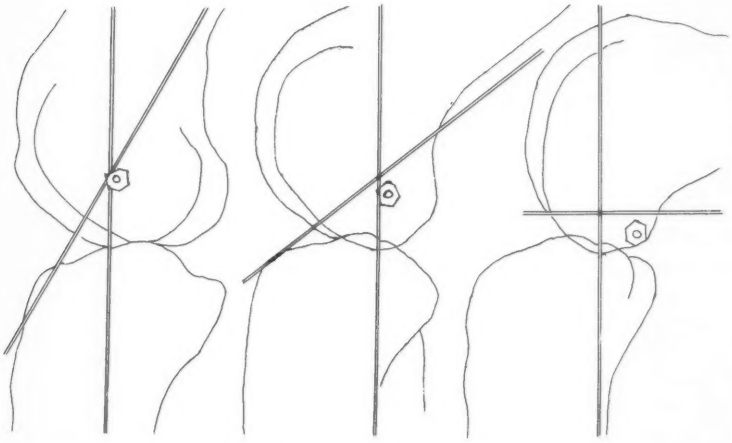


Figure 15. Drawings made from roentgenograms, showing displacement of a mark on the skin and metal rods attached to the skin during a knee bend.

of the center was determined and that the rods do not give the exact angle formed by articulating bones.

DISCUSSION

No matter what method of determination of angles formed by articulating bones is used, there would be no assurance that the measurement would be true even if the bones were exposed and stationary. It would take several mathematicians, willing to compromise, in order to arrive at one decision. Measurements on a joint during motion are infinitely more difficult. A manual measurement becomes impossible. A photographic method would necessitate the use of more than one camera, because movement is seldom in one plane. Moreover, a certain amount of skin shifting and of change in muscle contour distorts the position of skin markings needed for photography. The electrogoniometer appears to be the instrument of choice. The combination of electrogoniometric and photographic methods would be of interest and might prove very useful.

At times it was not possible to duplicate the tracings of the migration of the center of rotation obtained for the same number of degrees and on the same person. Observations made during actual joint motion disclosed the fact that skin and muscle movement around the femur and tibia would affect the character of the tracing. In order to avoid the effect of muscle movement, a table and leg support should be utilized. This would allow both the upper and lower leg to be held securely in position and to be moved passively the desired number of degrees. Since this type of movement is passive, it should greatly reduce the effect of muscles on the stylus and paper of the center finder, and hence, the distortion of the tracing. This technic would also tend to minimize the effect of inward rotation of the tibia, which occurs at the beginning of flexion. Further experimentation with the center finder is necessary.

SUMMARY AND CONCLUSIONS

The elbow and knee angles were measured by 3 instruments: manual goniometer, electrogoniometer, and 2 steel rods. Measurements obtained with the electrogoniometer are somewhat larger than those obtained with the manual goniometer and smaller than those obtained with the rods.

The electrogoniometer was tested for validity, reliability, and objectivity; all 3 attributes were found to be high. Validation of the

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electrogoniometer was attempted on cadavers but was found to be too involved and was therefore discontinued.

Electrogoniometric records of angles formed in the knee joint during various activities were made. The activities studied were: trunk bending and squatting, knee bend in prone position, stepping up and down on a bench, walking, running, and bicycling. Records were also made of knee angles in prosthetic and paralytic legs.

An instrument called a center finder is described.* This instrument may be used in locating the axis of rotation of a joint, and therefore may be of use in orthopedics, including prosthetic work.

ACKNOWLEDGMENT: The authors wish to express their gratitude to Messrs. George P. Karpovich, Richard H. Verzone, Robert R. Dering, and Miss Clare E. Condron for technical assistance in this study. Mr. Karpovich designed and built the large meter used in instantaneous reading of goniometric measures. Thanks are also extended to Sheriff David J. Manning for permission to do testing in the Hampden County Jail; Dr. Emery Seymour for help with statistics; Miss Teresa Regina and Mr. Melvin Stephens for art work; and Dr. Josephine L. Rathbone for continuous counseling and help in preparation of the manuscript.

REFERENCES

1. KARPOVICH, P. V. and WILKLOW, L.B.: A Study of the Human Foot in Standing and Walking. Final Report to the Office of the Surgeon General, Washington, D.C., Dec. 24, 1958. Also published as Goniometric study of human foot in standing and walking. *U.S. Armed Forces M.J.* 10: 885–903, Aug. 1959.
2. KARPOVICH, P. V. and KARPOVICH, G. P.: Electrogoniometer; new device for study of joints in action. (Abstract) *Fed. Proc.* 18: 79, Mar. 1959.
3. STRASSER, H.: *Lehrbuch der Muskel-und Gelenkmechanik.* Verlag von Julius Springer, Berlin, 1917.

*Since the completion of this report, the center finder has been modified to simplify its use. The principle, however, remains the same.

SCIENTISTS ANONYMOUS

The work of great painters or poets remains with us today still fresh and enjoyed by many, but the work of great scientists is far less fortunate. It is buried under the additions of later generations of workers; and, although it serves as a foundation, it is all too often taken for granted or forgotten altogether.—The History of Filaria (Annotations). *The Lancet*, November 21, 1959.

Case Reports

Anaphylactoid Reaction to Oral Penicillin

MAJOR PERRY B. MILLER, USAF, MC

ANAPHYLACTOID REACTIONS to penicillin given orally were first reported in 1953.[1-3] In a review of the literature in 1957, Maganzini found 13 cases of anaphylactoid reactions to oral penicillin and added 2 cases of his own.[4] Since then 3 more cases have been documented.[5-7] The following case report depicts a severe anaphylactoid reaction to a tablet (200,000 units) of crystalline penicillin G.

CASE REPORT

A 34-year-old pilot was brought to the emergency room of this hospital on 13 August 1959. His wife stated that about 25 minutes earlier he had taken a penicillin tablet (left over from a previous prescription) for a slight earache. Within a minute he had complained of weakness, generalized pruritus, sneezing, and swelling of his lips and tongue. He went to bed, and asked for a Chlor-Trimeton (chlorprophenpyridamine) maleate tablet. During the next 10 minutes he remained in bed and asked to be left alone. He then arose to go to the bathroom but collapsed after a few steps. Fecal incontinence followed, after which he could not be aroused, remaining unconscious during the 15-minute trip to the hospital.

A past history was obtained after the patient's recovery. In 1951, an injection of penicillin in beeswax was followed by the development of a skin rash. This, however, was believed to be due to sensitivity to the beeswax, because subsequently on a number of occasions he received penicillin parenterally without incident. Mild urticaria first developed in January 1959 and recurred at irregular intervals from then on. In February he received a course of oral crystalline penicillin G as prophylaxis against scarlet fever, for which his daughter was being treated. He apparently had mild urticaria at this time but no more than he had suffered previously. In April and May, in addition to recurrent urticaria, he had several attacks of nausea, weakness, and swelling of his lips and tongue. He noticed that these episodes all occurred shortly after eating and that he had drunk milk on each occasion. A physician suggested that abstinence from dairy products was worth a trial. After this, adhering to this suggestion, he had no recurrence of urticaria or angioneurotic edema until the onset of the anaphylactoid reaction.

Physical examination revealed a well-developed, well-nourished, comatose white male. His blood pressure was 30/0 mm Hg, pulse rate 90. His lips and

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tongue were moderately swollen. A few scattered wheezing rales were heard on auscultation of the lungs. The remainder of the physical examination was negative.

Epinephrine (1:1000), 0.5 ml, was given intravenously and 1,000 ml of 5 percent dextrose by intravenous drip was begun, followed by 20 mg of Vasoxyl (methoxamine) hydrochloride within a 10-minute period, and 100 mg of Solu-Cortef (soluble hydrocortisone) both administered through the intravenous tubing. The systolic blood pressure rose to 70 mm Hg. An intravenous infusion of 500 ml of 5 percent dextrose in water containing 2 ml of Levophed (levarterenol) bitartrate 0.2 percent was begun, following which a systolic blood pressure of 100 mm Hg was maintained with ease by adjustment of the drip. The patient became semiconscious about 15 minutes after admission to the hospital and regained full consciousness in another 10 minutes. At this time he complained of weakness and some vague abdominal pain, later discovered to be due to spasm of the cremasteric muscles with retraction of the testicles. During the next 30 minutes the patient vomited several times. He could remember no events subsequent to the symptoms that had developed in the first minute after ingestion of the penicillin tablet. The patient was transferred to the intensive treatment ward, where 0.3 ml of 1:1,000 epinephrine was injected subcutaneously and 800,000 units of Neutrapen (penicillinase) was injected intramuscularly. The intravenous drip of Levophed was discontinued about 1 hour after its initial administration. During the night, 1,000 ml of isotonic saline containing 100 mg of Solu-Cortef was given by intravenous drip at a rate of 100 ml per hour.

Acthar gel, 40 units, was injected intramuscularly the following morning. At this time the patient was entirely asymptomatic.

He was discharged 3 days after admission. He was warned of the extreme danger that any contact with penicillin represented to him, and advised to eliminate dairy products from his diet.

COMMENT

Although anaphylactoid reactions to oral penicillin are rare, a sufficient number of severe reactions have occurred to warrant the same precautions in its use that one takes before the parenteral administration of penicillin, i.e., obtaining a careful history to exclude previous allergy to penicillin, and proceeding with caution when a patient gives a history of other types of allergy.

Attempts to prevent self medication should be made. Only sufficient medication for the specific illness being treated should be prescribed, and the patient should be instructed to take all the medicine even though he "feels well" after a few days. This would seem unworthy of emphasis if one did not see so many examples where self medication, with improper indications and dosage, is attempted with surplus drugs from a previous prescription.

The contamination of milk by penicillin as a result of the treatment of mastitis in dairy cattle by the instillation of the drug into the teat duct has further complicated the problem of penicillin allergy. Zimmerman [8] has reviewed this problem and has demonstrated

through the prophylatic and therapeutic use of penicillinase that cases of chronic urticaria have resulted from the ingestion of milk and other dairy products contaminated with penicillin. He points out that the Food and Drug Administration, attempting to solve this problem, is hopeful that a nontoxic dye may be found that when added to the penicillin used for the treatment of mastitis will make it possible to identify contaminated milk.

The history of the patient in this case report suggests that milk contaminated with penicillin may have been responsible for his chronic urticaria and angioneurotic edema, since these manifestations did not recur after the elimination of milk and other dairy products from his diet. Of course, the possibility of allergy to both milk and penicillin cannot be excluded by the history alone.

For the present, it would seem wise to forbid the use of milk and other dairy products to the patient who has experienced an anaphylactoid reaction to oral penicillin. Although no cases have been reported of anaphylactoid reactions to penicillin in milk, it does not seem unreasonable to predict that, with an increasing awareness by physicians of this possibility, such case reports may appear.

SUMMARY

An anaphylactoid reaction to oral crystalline penicillin G is reported. The problem of self medication and the potential danger of reactions to penicillin in milk and other dairy products are discussed.

REFERENCES

1. Welch, H., Lewis, C. N., Kerlon, I. and Putnam, L. E.: Acute anaphylactoid reactions attributable to penicillin. *Antibiotics & Chemother.* 3:891–895, Sept. 1953.
2. Pierce, H. E., Jr.: Anaphylactoid reaction due to oral penicillin; case report. *J. Nat. M.A.* 45:68, Jan. 1953.
3. Blanton, W. B. and Blanton, F. M.: Unusual penicillin hypersensitiveness. *J. Allergy* 24:405-406, Sept. 1953.
4. Maganzini, H. C.: Anaphylactoid reaction to penicillins V and G administered orally; report of 2 cases and brief review of subject. *New England J. Med.* 256:52–56, Jan. 10, 1957.
5. Gullatt, R.: Brief recording: anaphylactic shock from penicillin lozenge. *New England J. Med.* 257:1037, Nov. 21, 1957.
6. Martin, F. J.: Anaphylactoid reaction to oral penicillin; report of case. *Ann. Int. Med.* 49:662–665, Sept. 1958.
7. Fraser, H.: Immediate anaphylactic shock from oral penicillin. *Med. J. Australia* 2:801, Dec. 13, 1958.
8. Zimmerman, M.C.: Chronic penicillin urticaria from dairy products, proved by penicillinase cures. *A.M.A. Arch. Dermat.* 79:1–6, Jan. 1959.

The Psychiatrist as Probation Officer

LIEUTENANT JOHN C. KRAMER, MC, USNR
LIEUTENANT COMMANDER JOHN L. YOUNG, MSC, USN

THE ARMED FORCES as a society, similar to civilian society, must rehabilitate criminal offenders. Civilian courts and correctional authorities employ probation and parole officers, whose efforts are directed toward helping the offender to accept society's standards of behavior, and toward having society accept the offender. A similar probation system has a definite place within the military forces.[1]

It is unfair to civilian society and unfair and costly to the armed forces and the individual concerned to separate him for disciplinary reasons if he can be rehabilitated. But some offenders have neither the capability nor the desire to serve in the armed forces; their past behavior usually gives sufficient grounds for their discharge from the military according to existent regulations and directives. Others, on the contrary, have potential value and may be sufficiently well motivated to perform creditable service.[2] The staff psychiatrist can quite often identify the former; but the selection, study, and restoration of the latter must be made by the commanding officer with the assistance of social workers, psychiatrist, chaplain, and legal officer.

For the habitual offender, the psychotic, the homosexual, the alcoholic, or the drug addict, appropriate arrangements for hospitalization, medical disposition, or appearance before an appropriate board for administrative discharge can easily be made.[3] A program of rehabilitation directed at one who can profit from it, however, is a more comprehensive problem. The individual offender must be studied to discover his motives, his patterns of behavior, and his needs, so that he can best be helped to adapt to the codes of an orderly society.[4] The cure of the delinquent requires that behavior patterns be changed in the direction of social conformity. Such a change is basic, involving as it does reorganization and reintegration of the individual's entire relationship with the world in which he lives and the people with whom he comes in contact. His attitudes, social technics, and emotional expectations may have to undergo considerable alteration.[5] Obviously, achievement of these ends is not necessarily within the exclusive capability or function of a psychiatrist, chaplain, or legal officer.

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The position of probation officer, as with other similar special functions ordinarily performed in civilian life by experienced professional personnel, must be occupied in the armed services by officers with little or no preparation for the task. Probation problems in military establishments are discussed by Holland and Luszki[6] and interpersonal relationships with probationers are presented by Burbank and Goldsborough.[7] Under certain circumstances, it would seem desirable to employ a psychiatrist for this job. Although psychiatrists are being utilized to an increasing degree to assist adult and juvenile probation authorities, a psychiatrist is not ordinarily in a position to act as a probation officer. The opportunity to play such a role arose at a naval hospital and is described in the following report.

CASE REPORT

The offender, a 19-year-old single white sailor of lower middle-class background, had received a letter from his mother stating that she needed money for an operation and expected her son to send it immediately. The day he received the letter he stole a camera, a radio, and a pair of binoculars from the open locker of another enlisted man in the barracks. Originally intending to sell these articles, he kept them in a suitcase under his bed for several days. During the investigation of the theft he secretly returned the property, placing it beneath the bed of the owner. As a prime suspect, he was interrogated and admitted his guilt. In his confession he stated: "When I took the property I thought I could sell the items but I just couldn't do it." Because of the circumstances surrounding the theft, he was sent for psychiatric evaluation prior to mast action.

A mental examination revealed the accused to be a passive-dependent individual who appeared to have been in an acute situational turmoil at the time of his alleged offense. Significant in his past history was the fact that his father died accidentally when the patient was 6 years old and that for about 6 months afterward he could not actually believe that his father was dead. From time to time throughout the remainder of his childhood, he had hallucinatory episodes in which he heard his father telling him to take care of his mother and brother. His mother had been suffering recently from an unspecified cardiac condition as well as from episodes of a possible dissociative nature. During examination, he expressed regret for not having been able to do more for his mother, reproaching himself repeatedly for not having shown her greater care. He recalled that on one occasion during "a spell" his mother almost shot herself accidentally and he repeated how unbearable it would be to him to lose his mother. The reason he gave for enlisting in the Navy was to decrease the number of "mouths to feed" at home.

The Mental Responsibility Board concluded that the accused was capable of differentiating right from wrong at the time of the act, was capable of adhering to the right (although, considering the crime and the circumstances surrounding it, certain factors impaired his ability to adhere to the right), and finally that he was capable of co-operating in his own defense. It was also found that he was correctly oriented in all spheres, revealing no evidence of thought or affective disorder, that his affect was flexible and in keeping with thought content. Based on these findings and the evidence, trial by special court-martial was directed. He

was convicted of theft as charged, on a plea of guilty, and was sentenced to a bad conduct discharge, 30 days confinement at hard labor, and reduction in rate.

Although not outstanding in any respect, the prior record of the accused was not marred by either previous conviction or nonjudicial punishment. Because of this and because of extenuating and mitigating factors, the convening authority suspended the bad conduct discharge and the confinement for 6 months, at which time, unless the suspension was vacated sooner, the suspended portion of the sentence was to be remitted without further action. This mild action, for an offense normally considered to involve moral turpitude warranting discharge from the service, was based on a conclusion that this particular offender was not at heart a thief and that he could be restored immediately to useful service.

It was realized, however, that particularly during the probationary period, the parolee would need help, because the threat of a bad conduct discharge might not be enough to overcome the bitterness and antagonism toward authority engendered by the probable scorn and rejection, real or imagined, of his associates and superiors. It was felt that he might then develop a "what's-the-use" attitude leading to compensatory misconduct if thoughtless and uncomprehending persons caused him to feel unwanted. Accordingly, on the theory that assisting persons in regaining confidence and self respect, evaluating tensions and attitudes, and suggesting constructive courses of action are functions of a psychiatrist, one of the authors (J. C. K.) was appointed probation officer in this case.

The parolee was interviewed at regular weekly intervals for periods of 15 to 45 minutes. He was informed that the interviewer was his probation officer, but by tacit agreement the interviews followed the pattern of supportive psychotherapy. In the period of approximately 5 months during which these interviews were held, two major problems concerned the probationer. One was his feeling of guilt and worry about the surgical procedure on his mother. Neither his mother nor other relatives or friends confided in him, either as to the nature of the operation or the condition of his mother during this time. Only after a period of several weeks did he learn that she was in satisfactory health. The other situation that plagued him through the entire period was a complicated romantic intrigue with a 17-year-old girl who returned his affection. Although the girl's mother approved of his keeping company with her daughter, the girl's stepfather soon sustained an active dislike for him and made every effort to keep them apart. It was quite apparent through the entire affair that both the probationer and the girl were seeking new objects for their unsatisfied dependency needs. These two situations considerably agitated the man, and it is likely that without the support he received, some unwarranted reaction would have occurred earlier to complicate his disciplinary status.

Toward the end of his probationary period, the man was discovered in possession of a pair of trousers belonging to another sailor. When confronted, he made a full confession of theft, stating: "I took them knowing that I would be caught and probably kicked out of the Navy, which was what I wanted." Because of this offense, proceedings were then held with a view to vacating the suspended sentence. This action was recommended and, on review, approved. Since then, the probationer has been discharged.

DISCUSSION

The unconscious—or perhaps not so unconscious—intent behind this last offense (to activate a conditionally suspended bad conduct dis-

charge) poses several questions, some specific to the case and some general. Although the probationer expressed some feelings of discouragement during the interviews, it appeared, and still appears in retrospect, that he intended to complete his probationary period satisfactorily. He had put considerable effort into applying for admission to a naval technical school and had been accepted. Despite contrary impulses, he avoided open friction with his girl friend's stepfather. He applied for and obtained leave to visit his family, whose health and financial condition he found satisfactory. When the fact that he had misappropriated a pair of trousers became known, he denied his guilt to the probation officer but admitted it to the legal officer. It is evident that in his relationship to the probation officer the man was neither as truthful as he should have been with a psychiatrist nor as obviously evasive as he might have been with a nonpsychiatric probation officer. Perhaps this state of affairs was induced by the probation officer's conflicting roles. He was appointed probation officer because he was a psychiatrist and because the offender's difficulties were largely neurotic, but he was primarily responsible not to the offender, but to the convening authority of the court.

Can psychiatrists be profitably and effectively used as probation officers in certain selected cases? From the experience gained in this case, the authors believe that because of the diverging responsibilities of the probation officer and the psychiatrist, the former responsible largely to the court, the latter to the patient, completely satisfactory service to either party is difficult for a psychiatrist as probation officer to accomplish. Although it is a probation officer's duty to do what he can to assist the offender in adhering to the law, it is also his responsibility to report any violation of probation. In his unusual and difficult position, the psychiatrist may face a conflict between his duty toward the court and his duty toward the convicted man. Whenever it is determined that a probationer can profit from psychotherapy during his period of probation, it would be advisable for a psychiatrist to act strictly in his professional capacity, another officer being appointed as probation officer. Such a program would be particularly indicated in the armed forces, where a relatively large portion of offenders come from the ranks of immature young men whose psychopathic tendency is not marked.

SUMMARY

The case of a rather impulsive and dependent young sailor who stole in response to guilt feelings is presented. The attempt to maintain

him as a useful member of the armed forces by the device of employing a psychiatrist to act as probation officer is described. A discussion of the limitations of this technic is presented.

REFERENCES

1. FRANK, W. F.: For the probationer—what? *U.S. Naval Inst. Proc.* 89:69–71, June 1958.
2. COOKE, E. T.: Soldiers, stockades, and psychiatry. *U.S. Armed Forces M. J.* 10:553–569, May 1959.
3. BUSHARD, B. L. and DAHLGREN, A. W.: Technic for military delinquency management. *U.S. Armed Forces M. J.* 8:1745–1760, Dec. 1957.
4. DRESSLER, D.: *Parole Chief*, Viking Press, New York, N.Y., 1951, p. 207.
5. PEIZER, S. B., LEWIS, E. B. and SCOLLON, R. W.: Correctional rehabilitation as function of interpersonal relations. *J. Crim. Law, Criminol. & Police Sci.* 46:632–640, Jan.–Feb. 1956.
6. HOLLAND, J. P. and LUSZKI, W. A.: Special supervision for military offenders. *J. Crim. Law, Criminol. & Police Sci.* 49:444–446, Jan.–Feb. 1959.
7. BURBANK, E. G. and GOLDSBOROUGH, E. W.: The Probation Officer's Personality: A Key Factor in Rehabilitation. *Federal Probation*, 18:12–14, June 1954

MUNCHAUSEN'S SYNDROME

I have only once named a disease and that was Munchausen's syndrome. I discovered nothing about it; I only described something that most doctors knew already and gave it a name. Yet the effect of christening it astounded me: case-reports, articles, and correspondence on the subject have continued ever since, both here and abroad; new names are added to make it more confusing, and new explanations offered for its occurrence (in America the allegation has been made that it is only caused by the National Health Service). Finally, a psychiatrist and a psychologist have been making a special study of it for over 4 years; they have a flying squad standing by for 24 hours a day ready to collect cases from anywhere in the country. They keep them in for months (to the great benefit of the community) and they ask them what different-shaped ink splodges remind them of (with less definite benefit to the community).—RICHARD ASHER: Making Sense. *The Lancet*, September 19, 1959.

Technical Notes

Hospital Decontamination with Beta-Propiolactone Vapor

MAJOR MARIE F. WOODWARD, NC, USAR
LIEUTENANT COLONEL ALICE B. CLARK, NC, USA

BETA-PROPIOLACTONE VAPOR has been used 3 times within the past year for hospital disinfection. It was used in single rooms on 2 occasions and in the entire main hospital building once. On all 3 occasions equipment was left within the area to be disinfected and was found to be undamaged after the decontamination procedure.

The procedure for decontamination with beta-propiolactone vapor was developed by the U.S. Army Chemical Corps, and has been used to decontaminate barracks, laboratories and similar structures.[1] These tests, and additional laboratory studies, have shown that beta-propiolactone vapor used under appropriate conditions is an effective sporicide (e.g., against spores of *Bacillus anthracis* and *Clostridium sporogenes* [2]) and bactericide (e.g., against *Micrococcus pyogenes* var. *aureus* [1] and *Mycobacterium tuberculosis* [2]). Killing activity has been demonstrated on the causal agents of Venezuelan equine encephalitis, smallpox, yellow fever, psittacosis and Q fever.[2, 3] The rate of action is directly related to the concentration, humidity, and temperature at which it is used. It was also shown that beta-propiolactone in concentrations and time exposures effective for disinfection purposes did not have a deleterious effect on most metals, plastics, and textiles. At ordinary indoor temperatures beta-propiolactone does not create a flammable mixture in air. The vapor is irritating to the mucous membranes of the eyes and nose. Undiluted preparations have no harmful effects on the skin if washed off immediately, but blisters may form if contact is extended over a period of 10 to 30 minutes.

Data collected in laboratory studies show that beta-propiolactone used as a vapor-phase disinfectant under conditions of maximum effectiveness is approximately 25 times more active than formaldehyde, 4,000 times more active than ethylene oxide, and 50,000 times more active than methyl bromide against the spores of *Bacillus subtilis*

From U.S. Army Medical Unit, Fort Detrick, Maryland.

var. *niger*. However, beta-propiolactone does not possess the high degree of penetration or the effectiveness of ethylene oxide [1] at low relative humidities.

Since beta-propiolactone does not condense as a nonvolatile residue, the time required to aerate a room or building is much less than that needed for formaldehyde. With open windows or doors aeration requires 1 or 2 days. Forced ventilation reduces airing time to a few hours.

Because of these properties it was decided to test the usefulness of this form of disinfection in an entire hospital area. Personnel from the physical defense division at Fort Detrick provided the beta-propiolactone and equipment, and conducted the actual spraying.

PROCEDURE

Disinfection of Single Room and Bathroom

Beta-propiolactone was first used in the hospital area in a single room. The following articles of furniture and equipment were left in the room for disinfection: bed, dresser, chairs, and linen; oxygen cylinder with cart; oxygen tent; complete resuscitator; Sklar compressor unit; vaporizer; portable x-ray machine; basins and bedpans; stethoscopes; sphygmomanometer; ophthalmoscope; vacuum water pitcher, brushes, flashlight and rubber goods; and the patient's personal effects.

The volume of the room and adjoining bathroom was about 1,170 cubic feet. Prior to decontamination all interior doors were opened, the air conditioner turned off, and the door to the corridor sealed with masking tape. The relative humidity in the room was 90 percent and the temperature 80° F. The lactone was aerosolized by a Tokheim Power Atomizer Model 590. The quantity of lactone used produced a concentration of approximately 100 mg per cubic foot of air.

The suite was aerated after 2 hours' exposure to the vapor, using the air conditioner and the open bathroom window, with a fan placed on the floor near the window to force the air out. Because it was necessary to keep the corridor door closed, ventilation was difficult. After an overnight airing, the room could be entered without difficulty, and the corridor door left open without a noticeable odor.

Since beta-propiolactone does not possess the penetrating powers of ethylene oxide, certain items of equipment were also treated with an ethylene oxide-Freon mixture in a sealed polyethylene bag.[4] The items included the valves and rubber face pieces of the resuscitator, stethoscopes, sphygmomanometer, ophthalmoscope, vacuum water

pitcher, brushes, flashlight, rubber goods, the plastic curtain from the oxygen tent, and the patients' personal effects.

Swabs taken from various parts of the room and pieces of equipment following these procedures showed complete absence of bacterial growth.

A few months later, general decontamination of another room and bath unit with furnishings and equipment was conducted with beta-propiolactone vapor. The results were as satisfactory as in the previous instance.

Disinfection of Main Hospital Building

At a later date, a routine decontamination of the main hospital building was carried out. Hospital activities were transferred temporarily to an adjoining building, along with supplementary supplies needed in this stand-by ward. Foodstuffs in paper or cardboard containers were removed from the food-service department and stored in the stand-by ward. Only x-ray film and cassettes were removed from the x-ray department. All operating-room equipment, including lights, electrosurgical instruments and anesthesia machines, remained in the suite. Drugs in tightly closed containers, linen, instruments, stationery supplies, draperies, books, and television sets were also left in the rooms.

The main hospital building is constructed in the form of a cross with 2 corridors intersecting in the center. The longer corridor is flanked by patients' rooms with adjoining baths, offices, kitchen and scullery, and utility and supply rooms. One end of this corridor terminates in a large dayroom. The operating room, x-ray and darkroom suite, reception, emergency, and central materiel rooms are off the shorter corridor. The volume of this entire area is approximately 89,000 cubic feet. The floors are asphalt title with the exception of the operating room, which has a nonconductive vinyl-plastic floor; walls are ceramic tile.

Prior to decontamination with the beta-propiolactone all interior doors and doors of cabinets, except those containing drugs or surgical instruments, were opened, and all drawers were pulled part way out. Windows were closed but unlocked, and screens were unlatched so that the windows could be opened from the outside after exposure. The ventilating system and air conditioners were shut off. Exterior doors were sealed with masking tape. Two hygrothermographs were placed in the ward to record temperature and relative humidity during the procedure. Finally, aliquots of an aqueous *B. subtilis* var.

niger spore suspension, about 500,000 organisms per ml, were smeared on 31 different sites in the ward.

A 2-wheeled pushcart-mounted insecticide sprayer, which sprayed a mixture of compressed air and liquid from 4 nozzles located at the end of a wand, was used to disseminate the lactone. When about two thirds of the building had been treated, the copper fuel line of the sprayer broke, and the remaining area was treated with 2 Tokheim atomizers, which were moved from room to room. Two men in protective clothing conducted the spraying. The temperature within the building during the decontamination procedures was 79° F; the relative humidity 87 percent.

Two hours later the windows and exterior doors of the building were opened. Personnel were able to enter the building in about 1 hour, with only slight irritation to mucous membranes of the nose and eyes, although there was considerable variation in the susceptibility of individuals to the vapor. After airing the building overnight there was no discernible odor.

Swab samples taken following the decontamination showed that 30 of the 31 sites contaminated with the *B. subtilis* spore suspension were sterile. Viable organisms were recovered from the site where the last of the spore suspension had been discarded and where, consequently, a much larger number of organisms had been deposited.

A careful inspection was made of the entire building and all furnishings and equipment before regular activities were resumed. The decontaminating agent was found to have caused only minor damage. Although the liquid chemical leaked out onto the floor when the fuel line of the sprayer broke, there was no noticeable damage to the asphalt tile. The varnish on some doors, a library table, a sewing machine, and a few wooden toilet seats was blistered, perhaps because the vapor had been sprayed directly on the object with resulting condensation on the surfaces. Such damage should not occur if care is taken to avoid direct spraying of surfaces. The odor did not cling to draperies or linens. There was no evidence of damage to any of the equipment left in the building; all items were thoroughly tested and found to be operational.

While no formal study was made of the time required for transfer of activities and decontamination, it was felt that if necessary the whole procedure could be accomplished in 18 hours or less with forced ventilation.

Although no attempt was made to determine the total cost of these operations, it was estimated that the beta-propiolactone cost 90 cents for each room and bath unit, approximately 1,170 cubic feet, and $72 for the entire building, approximately 89,000 cubic feet.

SUMMARY

On the 3 occasions of its use, beta-propiolactone vapor proved to be a fast, efficient, and safe means of markedly reducing the bacterial count in hospital areas. With proper handling it can be used for decontaminating all items normally found in a hospital.

REFERENCES

1. Hoffman, R. K. and Warshowsky, B.: Beta-propiolactone vapor as a disinfectant. *Appl. Microb.* 6: 358–362, Sept. 1958.
2. Phillips, C. R. and Hoffman, R. K.: Personal communication.
3. Dawson, F. W., Janssen, R. J. and Hoffman, R. K.: Virucidal activity of beta-propiolactone vapor: effect on the etiological agents of smallpox, yellow fever, psittacosis and Q fever. Accepted by *Appl. Microb.*
4. Schley, D. G., Hoffman, R. K. and Phillips, C. R.: Simple improvised chambers for gas sterilization with ethylene oxide. Accepted by *Appl. Microb.*

Filter Press for a Small Pharmacy

LIEUTENANT HENRY S. RUDOLPH, MSC, USN

FILTERING bulk pharmaceutical liquids at military hospitals is not difficult as nearly all hospitals possess a filter press of a size to meet their particular needs. The smaller medical units, even those with a large volume of outpatient prescriptions, must, because of budgetary limitations, continue to use one of the antiquated, slow, limited-volume, gravity-type filter assemblies.

The pharmacy school at this hospital wished to incorporate instruction on the use and care of a filter press in its curriculum. It was found that the manufactured units ranged in price anywhere from $550 to $750, depending on the type of metal, for the very smallest complete press. Since the school had only a limited budget, each part of the press assembly was priced, and only the specialized filter, pump, and coupling were purchased. The cost of these parts amounted to less than one-third the price of the entire unit. The unit (fig. 1) consisting of filter, pump, motor, portable stand, containers, and tubing was completed locally. Total estimated cost of the filter press ready to operate was slightly less than $250 in contrast to $600 for the

From U.S. Naval Hospital, Portsmouth, Va. Lt. Rudolph is now assigned to the National Naval Medical Center, Bethesda, Maryland.

cheapest commercial unit of comparable construction and quality. In estimating the $250 cost of the entire assembly, the following factors were taken into consideration: price of pump and filter; depreciated value of both motor and truck; the cost of labor to service motor, install cord, alter truck; cost of carboys; and other incidental accessories.

Figure 1. Filter press mounted on metal truck with carboys in place.

This assembly, which is an excellent filter, can also be utilized to transfer bulk liquids from one container to another. The operation of the press for this purpose is exactly the same as for filtering, except that the filtering disks, rings, and screens are omitted when the filter is assembled for use.

DESCRIPTION OF THE ASSEMBLY

The filter, identified as A in figure 2, is of brass and bronze construction, nickel plated on exterior. Uses 4 filter disks, 5 inches in diameter, with approximately 65 square inches of filtration area or surface.

The pump, identified as B in figure 2, is a bronze, rotary-gear type, for handling thin to medium heavy liquids. Capable of creating a maximum pressure of 40 pounds, which will filter approximately 1.5 gallons of liquid per minute. Mounting brackets for pump and filter are fabricated in the metal shop from ¾- by 3/16-inch, rustproof metal. The coupling, C in figure 2, is commercially obtainable from the filter manufacturer. Connects motor and pump for direct-drive operation.

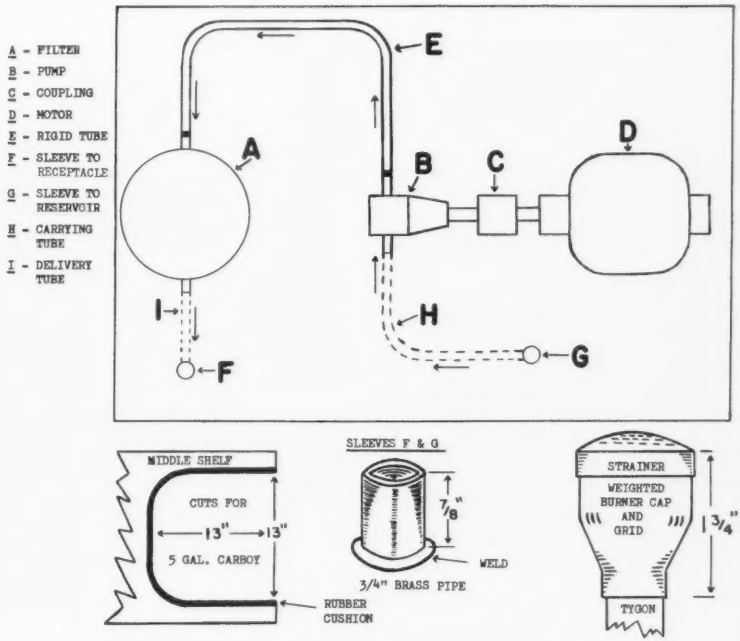

Figure 2. Diagram of the filter press.

The motor, identified as D in figure 2, is a ¼-h. p., 1725-r.p.m., 115-volt, 3.8-ampere, 60-cycle motor with built-in overload protection. Obtained from a surveyed water cooler, reconditioned at small cost, and equipped with a heavy-duty, waterproof cord with hand switch.

The stand illustrated in figure 1 is a converted stainless-steel, surplus truck commonly used by the food-service departments. This is described in the Federal stock catalog as: Truck, utility, #3920–794–0800. Because of its mobility, this type is best suited to our needs. Any heavy metal stand may be adapted to the assembly.

A 3/8-inch plastic tubing is used throughout. Clear, flexible tubing (Tygon) on lead from carboy to pump and filter to carboy, but semirigid (Saran) connecting

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the pump and filter. In an assembly to be used for other than demonstration purposes, a metal tube should connect the pump and filter, because of the great pressure that may build up as the filter disks become clogged.

The carboys shown are listed in the Federal stock catalog as: Bottle, carboy, 5-gallon, #8125–404–6400.

To prevent injury to the pump, through the possible introduction of large particles, the carrying tube leading from the reservoir carboy to the pump should be equipped with a weighted strainer. This strainer will also serve to keep the end of the tube on the bottom of the carboy, permitting complete filtration of most of the liquid. The one illustrated in figure 2 was made from a Bunsen burner cap with lead-weighted grid.

The truck required the most extensive alterations. Two circular cuts were made in the middle shelf (see figure 2) to accommodate the two 5-gallon carboys. The cuts were cushioned with heavy-gage rubber tubing to act as a bumper for the carboys. The filter, pump, and motor were placed on the top shelf in the exact positions they would occupy when assembly was complete and their outlines were clearly marked. Holes were drilled to mount the various components, along with 2 sleeved holes, F and G, for the intake and output tubes. All parts were assembled and secured to the shelf. To minimize vibration, the shafts of the motor and pump were placed in a direct line.

If a tube other than metal with coupling is used to connect the pump and filter, the ends must be tightly secured to outlets with clamps. The directions for operating and cleaning, as well as other information, are supplied with the pump and filter.

SUMMARY

The fabrication and assembly of an inexpensive unit for filtering bulk pharmaceutical liquids is described. The estimated cost of the completely assembled press is under $250.

HOW TO USE A NEW DRUG

If you do wish to consider the early use of new agents, select one at a time, carefully evaluate all of the available data on it, and reject its use unless there is clear evidence that it represents a real therapeutic advance. Thorough investigation of a few agents will always prove to be more profitable than cursory examination of many. It is desirable to select products for investigation from among those for which the manufacturer has provided relatively complete bibliographies. This simplifies the task, provides some selection on the basis that full information is more apt to be provided for those products in which the manufacturer himself has confidence, and finally, in the long run, such selection may induce manufacturers to provide more adequate information on their products.—MARK NICKERSON and JOHN P. GEMMELL: Doctors, Drugs and Drug Promotion. *Canadian Medical Association Journal*, April 1, 1959.

Military Medical News

Aerospace Medical Association Meets at Miami Beach, May 9–11

Dr. Ludwig G. Lederer, president of the Aerospace Medical Association, has announced that more than 250 aviation and space bioscientists will present the results of their latest research and achievements during the thirty-first annual meeting of the society at the Americana Hotel, Miami Beach, Florida, 9–11 May. Dr. Lederer is medical director of Capitol Airlines.

Under the chairmanship of Colonel James B. Nuttall, USAF, MC, deputy director of professional services, Office of the Air Force Surgeon General, the scientific program committee has selected for presentation a series of papers covering the many varied areas of aerospace medicine, with marked emphasis this year on space. A special luncheon session will include a panel discussion, "The Continuum of Man-Machine Systems from Aircraft to Space," sponsored by the Space Medicine Branch, with Captain Clifford P. Phoebus, MC, USN, and Commander G. W. Hoover, MC, USN (Ret.), presiding. During the second day a symposium on bioastronautics will be presented under the sponsorship of the Armed Forces National Research Council on Bio-Astronautics. Dr. Otto H. Schmitt, and Dr. Sam F. Seeley will preside.

Other sessions will be held on clinical aerospace medicine, thermal stress, physiology of acceleration, human engineering of aerospace vehicles, aerospace pathology and physiology, crew performance, aerospace equipment design, space environment simulators, angular acceleration, life support technology, biodynamics of impact forces, decompression, weightlessness, emergency escape, radiobiology, sealed cabin atmospheres, and the biodynamics of mechanical vibration. Papers will also be presented by representatives from Norway, Sweden, England, and Canada. A special progress report on Project MERCURY, sponsored by the National Aeronautics and Space Administration, will close the meeting.

Colonel Nuttall

The sixth Louis H. Bauer Lecture, established in 1955 as a tribute to the Association's founder and pioneer military flight surgeon, will be given 9 May by Dr. Detlev Bronk, president, National Academy of Sciences, and the Rockefeller Foundation. An honorary fellow of the Association and coordinator of medical research in the Army Air Forces in World War II, Dr. Bronk was the second recipient of

the Raymond F. Longacre Award.

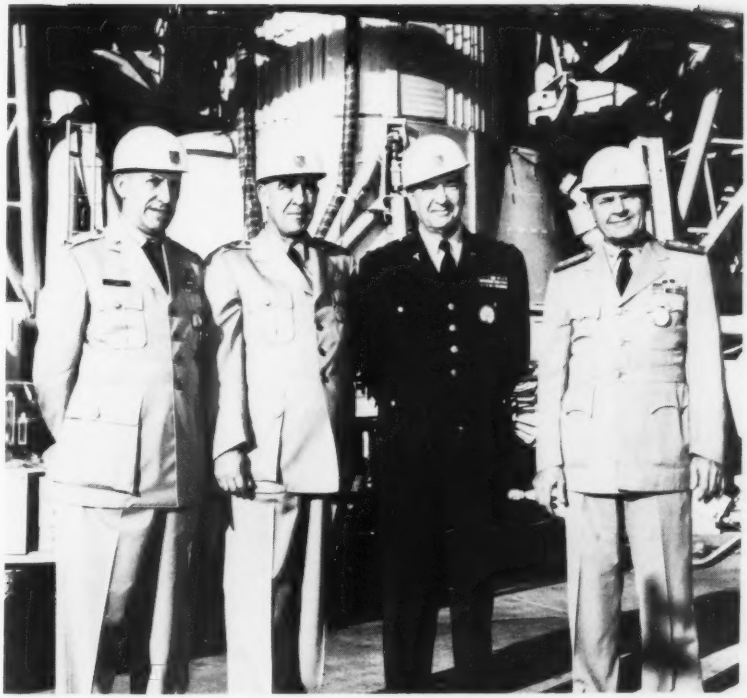
Officers and scientists of the military services presiding at the various sessions are Rear Admiral James L. Holland, MC, USN; Brigadier General Donald D. Flickinger, USAF, MC; Colonel Vincent M. Downey, USAF, MC; Colonel Joe M. Blumberg, MC, USA; Colonel Harold V. Ellingson, USAF, MC; Colonel A. P. Gagge, USAF, MC; Colonel Paul A. Campbell, USAF, MC; Colonel Gerrit L. Hekhuis, USAF, MC; Colonel John P. Stapp, USAF, MC; Commander G. W. Hoover, MC, USN (Ret.); Lieutenant Colonel Rufus R. Hessberg, Jr., USAF, MC; Major F. Warren Lovell, USAF, MC; Major Charles A. Berry, USAF, MC; Captain Ashton Graybiel, MC, USN; Captain Henry G. Wagner, MC, USN; Captain Roland A. Bosee, MSC, USN; Captain Clifford P. Phoebus, MC, USN; Captain Frank B. Voris, MC, USN; Captain Charles F. Gell, MC, USN; and Commander David E. Goldman, MC, USN.

The annual recipients of the Lyster, Longacre, Tuttle, and Liljencrantz Awards, presented by the Association for achievements in aerospace medicine, will be announced during the traditional banquet on the last day of the meeting.

New Blood Bank Directory

The Joint Blood Council, a nonprofit organization supported by the American Association of Blood Banks, American Hospital Association, American Medical Association, American Red Cross, and the American Society of Clinical Pathologists, will publish a new directory of blood transfusion facilities and services this spring. The directory will list hospitals using blood, hospital blood banks, Red Cross centers, and community blood banks that collect, process, and distribute blood, technical and operating procedures, and sources and usage of blood. Approvals, supervision, reciprocity exchange systems, and services such as tissue storage banks will also be included. The Council's first directory was published in 1956, and included 2,202 facilities throughout the United States.

NEW TINKER AIR FORCE BASE Hospital. Dedicated in January, this new 75-bed medical facility at Tinker Air Force Base, Oklahoma, will provide general medical and surgical inpatient service as well as a comprehensive outpatient service. The hospital is commanded by Lieutenant Colonel Herbert T. Clough, Jr., USAF, MC.



SURGEONS CONFER. Colonel George M. Knauf, USAF, MC (left), staff surgeon, Air Force Missile Center, Patrick Air Force Base, Florida, and recently appointed Department of Defense chief for bioastronautic support of Project MERCURY, discussed medical support of the man-in-space program recently with Army, Navy, and Air Force surgeons general. Shown with Colonel Knauf before the U.S. Air Force ATLAS ICBM are (left to right) Major General Oliver K. Niess, U.S. Air Force; Lieutenant General Leonard D. Heaton, U.S. Army; and Rear Admiral Edward C. Kenney, deputy surgeon general, U.S. Navy.

Army Nursing Award Given

The third annual Evangeline G. Bovard Award for professional achievement in the field of Army nursing was shared by Major Iola R. McClellan, ANC, operating room supervisor, and Captain Therese M. Brown, ANC, head nurse, women's medical section, Letterman Army Hospital, San Francisco, California. Colonel Robert Skelton, MC, USA (Ret.), who founded the award in honor of his wife, a former Army nurse, and Brigadier General A. L. Tynes, commanding general of Letterman, made the presentations at a command ceremony. Major McClellan, a graduate of Mt. Sinai Hospital, Cleveland, Ohio, has served with the Army Nurse Corps since 1940. Captain Brown, who graduated from Loyola University, Chicago, Illinois, entered the service in 1950.

Forensic Symposium at AFIP

A 3-day symposium to discuss problems of mutual interest to medical, legal, and law enforcement officers in the Armed Forces and other government agencies, will be conducted at the Armed Forces Institute of Pathology, Washington, D.C., 3–5 May 1960. Composed of lectures, panels, and demonstrations of toxicologic and other scientific methods used in investigations, the symposium is designed to indoctrinate hospital commanders, base and post surgeons, JAG and military police officers, along the lines of forensic science, and to establish better liaison between the responsible medical officer and the investigator.

The symposium marks the first time these disciplines from all 3 services have met to exchange views and discuss problem solutions in the medicolegal area. The program will be telecast to selected military installations throughout the Washington, D.C., area via closed circuit television.

Officers Certified By Specialty Boards

The surgeons general of the military medical services have announced that the following regular Medical Corps officers have been certified by the specialty boards indicated.

American Board of Dermatology

Howard, William R., Capt., USA
Lawler, James C., Capt., USA
Mendelson, Charles G., Capt., USA

American Board of Internal Medicine

Cardiovascular Disease

Hall, Robert J., Maj., USA

American Board of Ophthalmology

Dinsdale, Howard A., Capt., USA
Garland, Marvin A., Capt., USA

American Board of Pathology

Pathologic Anatomy

Budinger, John M., Capt., USA
Hope-Ross, Peter E., Capt., USA
Like, Arthur A., Capt., USA

American Board of Psychiatry and Neurology

Psychiatry

Hudson, Heber S., Maj., USA
Gordon, John N., Maj., USA
Law, Arthur G., Maj., USA
Parrish, Matthew D., Maj., USA

American Board of Surgery

Buttram, Thomas L., Capt., USA
DeVito, Nicholas J., Maj., USA
Towson, Travis J., Jr., Lt. Col., USA

Official Decorations

The following awards were recently announced by the Department of the Army and Air Force.

Legion of Merit

David Gold, Col., USAF, MC*
Bernard J. Kotte, Col., MSC, USA
William H. Powell, Jr., Maj. Gen., USAF, MC*

Army Commendation Ribbon with Metal Pendant

Peter J. Batten, Jr., Capt., MC, USA
Mildred I. Clark, Lt. Col., NC, USA
Ernest G. Crosby, Capt., MSC, USA
Thomas Laughlin, Jr., Lt. Col., MC, USA
J. L. Moreland, Maj., USAF, MSC
Edythe Turner, Lt. Col., NC, USA**

Air Force Commendation Medal

Alfred R. Stumpe, Maj., USAF, MC

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*First Oak Leaf Cluster
**Third oak leaf cluster.

Navy Honors Hoogstraal

The Secretary of the Navy Distinguished Civilian Service Award has been presented to Harry Hoogstraal, Ph. D., biologist at the Naval Medical Research Unit No. 3, Cairo, Egypt, for outstanding contributions to naval medical research in the field of epidemiology. As head of the Medical Zoological Department of the unit for the past 10 years, Dr. Hoogstraal has won recognition as a world authority in taxonomy and parasitology.

ACS Names 1961 Director

Colonel John Paul North, MC, USAR, chief of surgical service at Veterans Hospital in Dallas, Texas, will succeed Major General Paul R. Hawley, MC, USA (Ret.), as director of the American College of Surgeons in 1961, the society's board of regents recently announced. Dr. Hawley has served as director since 1950.

During World War II, Colonel North was chief of the surgical service in the 20th General Hospital, CBI Theater, and in 1945 received the Legion of Merit for outstanding service. He served as a consultant to the Army surgeon general, European Theater, in 1954. Since 1946 he has held an appointment as clinical professor of surgery at University of Texas Southwestern Medical School, in Dallas.

Deaths

KALAS, FRANK JOSEPH, Captain, DC, USN, of Cleveland, Ohio; assigned to U.S. Naval Dental Clinic, Camp Pendleton, California; graduated in 1936 from the University of Louisville School of Dentistry, Louisville, Kentucky; appointed a lieutenant (j.g.) in the United States Naval Reserve 8 June 1940; reported for active duty 20 June 1941; commissioned a lieutenant in the United States Navy 7 December 1942; died 31 December 1959, aged 47, at U.S. Naval Hospital, Camp Pendleton, of bronchogenic carcinoma with cerebral metastasis.

HULLINGHORST, ROBERT LEONCE, Colonel, MC, USA, of New Orleans, Louisiana; assigned as deputy commander, Medical Research and Development Command, Office of the Army Surgeon General, Washington, D.C.; graduated in 1938 from Louisiana State University School of Medicine, New Orleans; appointed a first lieutenant in the Army of the United States 28 May 1938; reported for active duty 1 July 1938; commissioned as a first lieutenant in the United States Army 1 July 1939; died 10 December 1959, aged 43, at U.S. Naval Hospital, Bethesda, Maryland, of a heart attack.

NELSON, FRANCIS CUSICK, Lieutenant Colonel, MSC, USA, of Omaha, Nebraska; assigned as chief, Technical Liaison Office, Office of the Army Surgeon General, Washington, D.C.; graduated in 1938 from the Municipal University of Omaha; appointed a second lieutenant in the Army of the United States and reported for active duty 24 February 1943; appointed a captain in the United States Army 5 April 1946; died 14 February 1960, aged 44, at Falls Church, Virginia, of a heart attack.

SHAW, CHRISTOPHER CAMPBELL, Captain, MC, USN, of Chichester, New York; assigned as medical officer, U.S. Naval Base and Shipyard, Philadelphia; graduated in 1931 from the University of Maryland School of Medicine, Baltimore; appointed as a lieutenant commander in the United States Naval Reserve 28 July 1940; reported for active duty 19 May 1941; commissioned as a captain in the U.S. Navy 8 January 1948; died 5 December 1959, aged 58, at U.S. Naval Hospital, Philadelphia, of pulmonary edema and myocardial insufficiency.

AF Names Chief Consultant

Colonel Don S. Wenger, USAF, MC, formerly deputy commander and chief, department of surgery, USAF Hospital, Lackland Air Force Base, Texas, has been appointed chief professional consultant to the Air Force Surgeon General. Colonel Wenger, a senior flight surgeon, is a fellow of the American College of Surgeons and International College of Surgeons, and a founder-senior fellow of the Air Force Society of Clinical Surgeons. He succeeds Colonel David Gold, USAF, MC, now serving as chief professional consultant in surgery with the 7112th Medical Group, Wiesbaden, Germany.

MUSEUM GIVEN DENTAL INSTRUMENTS. Captain Eric G. F. Pollard, DC, USN, right, commanding officer, U.S. Naval Dental School, Bethesda, Maryland, and Rear Admiral Curtiss W. Schantz, DC, USN, chief of the Dental Division, Bureau of Medicine and Surgery, present an ultrasonic dental cutting instrument and the original model of a dental air turbine handpiece to Frank A. Taylor, left, director of the Museum of History and Technology, Smithsonian Institution. The air turbine handpiece was developed at the Naval Dental School under the supervision of Admiral Schantz, then commanding officer of the school. The two instruments will be added to the museum's collection on the history of dentistry.

Progress Notes

Colonel **Laurence A. Potter,** MC, USA, assistant commandant of the Army Medical School, Fort Sam Houston, Texas, became chief of the Personnel and Training Division, office of the Army surgeon general, in January . . . Captain **Edward E. Hogan,** MC, USN, director of the Physical Qualifications and Medical Records Division, Bureau of Medicine and Surgery, has been named commanding officer of the U.S. Naval Hospital, Guam, succeeding Captain **Murphy K. Cureton,** MC, USN, who has been assigned as commanding officer of the U.S. Naval Hospital, Charleston, South Carolina . . . Captain **Edwin B. Coyl,** MC, USN, commanding officer, U.S. Naval Hospital, Newport, Rhode Island, has been assigned to the Inspector General Medical Department Activity, Bureau of Medicine and Surgery.

Captain **Frank E. Ceccarelli,** MC, USA, senior resident in urology, Brooke Army Hospital, and Lieutenant **Carter E. Carlton,** senior resident in urology, Baylor University College of Medicine, shared the James C. Kimbrough Memorial Award for 1959. The award, $25 for urological books, is given each year for the best presentation by Armed Forces residents at the annual Kimbrough seminar . . . Major **William R. Rule,** USAF, MSC, Armed Forces Institute of Pathology, and Major **Raymond L. Hodges,** USAF, MSC, U.S. Air Force School of Aviation Medicine, Gunter Branch, Alabama, were admitted to the bar of the United States Supreme Court, 23 November.

Captain **Drew F. Siebert** DC, USA, Ireland Army Hospital Annex Dental Clinic, received a certificate of achievement citing interest and devotion to duty during his 2-year tour at Fort Knox, Kentucky, on his release from active duty . . . Captain **Joseph S. Burkle,** MC, USN, clinical head of the Radio-Isotope Laboratory, U.S. Naval Hospital, St. Albans, New York, was recently promoted to his present rank . . . The Second U.S. Army Medical Laboratory, Fort George G. Meade, Maryland, celebrated the 12th anniversary of its organization on 22 January . . . The rotating dental internship program, begun 1 July 1958 at Fort Benning, Georgia, has been approved by the Council on Dental Education, American Dental Association.

Captain **Roger H. Fuller,** MC, USN, deputy director, Armed Forces Institute of Pathology, Washington, D.C., presented the annual Tufts Medical Alumni Lecture on 2 February at Tufts University Medical School, Boston, Massachusetts. Captain Fuller graduated from Tufts Medical School in 1938 . . . Lieutenant Colonel **Richard R. Taylor,** MC, USA, has been named chief of the Research Division of the Army's Medical Research and Development Command. Colonel Taylor also serves as chief of the U.S. Army Biophysics and Astronautics Branch . . . Captain **Robert B. Young,** DC, USN, Naval Air Station, Olathe, Kansas, has been assigned as executive officer, Naval Dental Clinic, Guam . . . Major **Ralph C. Singer,** MC, USA, has been appointed chief of the Environmental Hygiene and Nutrition Branches in the Army Surgeon General's Preventive Medicine Division.

Benford Named to PMA Post

Colonel Robert J. Benford, USAF, MC (Ret.), former editor of the *U.S. Armed Forces Medical Journal,* has been named director of medical relations for the Pharmaceutical Manufacturers Association, 1411 K Street, N.W., Washington, D.C.

The Medical Officer Writes

Articles Published in Other Journals

U.S. Army

Important Health Problems Experienced in the Army Missile Programs. Colonel John R. Hall, Jr., MC, USA, National War College, Washington, D.C. *Military Medicine*, October 1959.

Identification of Alkaloids and Related Compounds by Paper Chromatography and Ultraviolet Spectrophotometry. Russell Hilf, Ph. D, Frank F. Castrano, Ph. D, and George A. Lightbourn, M.S., 6th U.S. Army Area Medical Laboratory, Fort Baker, Calif. *Journal of Laboratory and Clinical Medicine*, October 1959.

Complications of Facial Fractures. Lieutenant Colonel Royce E. House, MC, USA, 2d General Hospital, Landstuhl, Germany. *Medical Bulletin of the U.S. Army, Europe*, September 1959.

Latex-Agglutination Serologic Test for Trichinosis. Filomena Innella, B.A., and Major Wallace J. Redner, MC, USA, 1st U.S. Army Medical Laboratory, New York, N.Y. *Journal of the American Medical Association*, 17 October 1959.

Isolation of *Mima Polymorpha* var. *Oxidans* From Two Patients With Urethritis and a Clinical Syndrome Resembling Gonorrhea. James Ino, M.S., Lieutenant Donald L. Neugebauer, MSC, USA, and Captain Richard N. Lucas, USAF, MC, Fitzsimons Army Hospital, Denver, Colo. *American Journal of Clinical Pathology*, October 1959.

Recognition of the Suicidal Patient. Captain Bertram S. Mersereau, MC, USA, 2d General Hospital, Landstuhl, Germany. *Medical Bulletin of the U.S. Army, Europe*, September 1959.

Cholangiolitic Hepatitis, Clinical-Pathologic Studies and Response to Steroid Therapy in Four Cases. Lieutenant Colonel Edwin L. Overholt, MC, USA, and Major E. B. Hardin, MC, USA, Fort Detrick, Maryland. *A.M.A. Archives of Internal Medicine*, June 1959. Condensed in *Modern Medicine*, 15 October 1959.

Inhibitory Effects of Kanamycin and Diffusion Into Various Body Fluids. Lieutenant Colonel Edwin J. Pulaski, MC, USA, and Richard S. Tubbs, Letterman Army Hospital, San Francisco, Calif. *Antibiotic Medicine*, October 1959.

Hypnoanesthesia in Obstetrics and Gynecology. Major Stephan N. Schanzer, MC, USA, 10th Field Hospital, Wurzburg, Germany. *Medical Bulletin of the U.S. Army, Europe*, July 1959.

Fatal Agranulocytosis Due to Phenylindanedione, Report of a Case. Captain Perry C. Smith, MC, USA, Brooke Army Hospital, Fort Sam Houston, Texas. *Annals of Internal Medicine*, September 1959.

The Treatment of Burns of the Hands. Lieutenant Colonel Wilfred T. Tumbusch, MC, USA, Lieutenant Colonel Edward H. Vogel, Jr., MC, USA,

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Titles of articles in current periodicals written by commissioned officers and civilian scientists in the medical services of the Department of Defense will be published each month insofar as space permits. This listing is gleaned from available periodicals and is not necessarily complete. Authors desiring inclusion of published articles are invited to send a reprint to the *Journal*.—Editor.

and Captain Jerome J. DeCosse, MC, USAR, Brooke Army Medical Center, Texas. *Modern Medicine*, 15 November 1959.

THE ALCOHOLIC PATIENT—HIS NEEDS AS MET BY ALCOHOLICS AND THE CASE-WORKER. First Lieutenant Peter T. Van Suetendael, MSC, USA, U.S. Army Hospital, U.S. Disciplinary Barracks, Lompoc, Calif. *Military Medicine*, December 1959.

TREATMENT OF FACIAL TRAUMA. Colonel Edward J. Whiteley, MC, USA, 98th General Hospital, Neubrucke, Germany. *Medical Bulletin of the U.S. Army, Europe*, July 1959.

OBSERVATIONS OF THE CARDIOVASCULAR SYSTEM IN EXPERIMENTAL TRAUMATIC SHOCK. II. THE NATURE OF THE "WOUND FACTOR." Captain Henry M. Wise, Jr., MC, USA, Lieutenant Colonel Douglas Lindsey, MC, USA, and First Lieutenant Albert T. Kneckt, Jr., CmlC, USA, Army Chemical Center, Edgewood, Maryland *Surgery*, October 1959.

PSYCHOLOGICAL INDOCTRINATION EFFORTS AMONG PRISONERS OF WAR IN KOREA. Lieutenant Colonel Frederick A. Zehrer, MSC, USA, Letterman Army Hospital, San Francisco, Calif *Journal of the Indiana Medical Association*, October 1959.

U.S. Navy

THE BIO-DYNAMICS OF LAUNCH AND RE-ENTRY. John Lott Brown, Ph.D U.S. Naval Air Development Center, Johnsville, Pa., and School of Medicine University of Pennsylvania, Philadelphia, Pa. *Military Medicine*, November 1959.

INTESTINAL BLEEDING AND PERFORATION COMPLICATING TREATMENT WITH VASOCONSTRICTORS. Captain Robert B. Brown, MC, USN, Lieutenant Bruce H. Rice, MC, USN, and Lieutenant Jeno E. Szakacs, MC, USN, National Naval Medical Center, Bethesda, Md. *Annals of Surgery*, November 1959.

STAPHYLOCOCCIC PULMONARY INFECTIONS. Captain George L. Calvy, MC, USN, Naval Medical Field Research Laboratory, Camp Lejeune, N.C. *Rhode Island Medical Journal*, November 1959.

AN ACCOUNT OF EXPERIMENTS IN WHICH TWO MONKEYS WERE RECOVERED UNHARMED AFTER BALLISTIC SPACE FLIGHT. Captain Ashton Graybiel, MC, USN, Colonel Robert H. Holmes, MC, USA, Dietrich E. Beisher, Ph.D., Major Gerald E. Champlin, MC, USA, George P. Pedigo, W. Carroll Hixon, Thomas R. A. Davis, M.D., Norman L. Barr, M.D., Wallace G. Kistler, Jorma I. Niven, Ph.D., Captain Edward Wilbarger, MSC, USA, Donald E. Stullken, Ph.D., Captain William S. Augerson, MC, USA, First Lieutenant Robert Clark, MSC, USAR, and Lieutenant James H. Berrian, MSC, USN, U.S. Army Ordnance Missile Command, Huntsville, Ala., U.S. Naval School of Aviation Medicine, Pensacola, Fla., U.S. Army Medical Research Laboratory, Fort Knox, Ky., U.S. Naval Medical Research Institute, Bethesda, Md., and Walter Reed Army Institute of Research, Washington, D.C. *Aerospace Medicine*, December 1959.

TRANSPLANTATION IMMUNITY: SOME PROPERTIES OF INDUCTION AND EXPRESSION. Lieutenant Charles F. McKhann, MC, USNR, and Lieutenant James H. Berrian, MSC, USN, U.S. Naval Medical Research Institute, Bethesda, Md. *Annals of Surgery*, December 1959.

THE DEVELOPING PHILOSOPHY OF SURGERY OF CANCER OF THE COLON. Captain

Ralph M. Mugrage, MC, USN, U.S. Naval Station, San Juan, Puerto Rico. *Postgraduate Medicine*, December 1959.

LYMPHOCYST FORMATION FOLLOWING PELVIC LYMPHADENECTOMY. Lieutenant James H. Nelson, Jr., MC, USN, and Captain J. Wilson Huston, MC, USN, U.S. Naval Hospital, St. Albans, N.Y. *American Journal of Obstetrics and Gynecology*, December 1959.

CHANGES IN INTERCAST DIMENSIONS PRODUCED BY MOUNTING PRESSURES. Lieutenant Commander Robert R. Perkins, DC, USN, U.S. Naval Medical Research Unit No. 3, Cairo, Egypt, and Captain Merrill G. Wheatcroft, DC, USN, U.S. Naval Dental School, Bethesda, Maryland. *Journal of the American Dental Association*, October 1959.

CENTRAL NERVOUS SYSTEM INJURY FROM HIGH RADIAL G FORCE. Captain Philip B. Phillips, MC, USN, and Commander Jerry J. Zarriello, MC, USN, U.S. Naval School of Aviation Medicine, Pensacola, Fla. *Aerospace Medicine*, November 1959.

MOTION SICKNESS: A PSYCHOPHYSIOLOGIC GASTROINTESTINAL REACTION. Commander Roger F. Reinhardt, MC, USN, Menninger Foundation, Topeka, Kans. *Aerospace Medicine*, November 1959.

TREATMENT OF INTRACTABLE BRONCHIAL ASTHMA, RESULTS IN 22 CASES. Captain Jacob J. Robbins, MC, USN, U.S. Naval Hospital, Portsmouth, Va. *American Practitioner Digest of Treatment*, December 1959.

RADIATION DOSAGE IN FLIGHT THROUGH THE VAN ALLEN BELT. Hermann J. Schaefer, Ph.D., U.S. Naval School of Aviation Medicine, Pensacola, Fla. *Aerospace Medicine*, September 1959.

POTABLE WATER RECYCLED FROM HUMAN URINE. Julius Sendroy, Jr., Ph.D., and Harold A. Collison, B.S., U.S. Naval Medical Research Institute, Bethesda, Maryland. *Aerospace Medicine*, September 1959.

REDUCED ORAL TEMPERATURES AND ACID PRODUCTION RATES IN DENTAL PLAQUES. Captain William R. Stanmeyer, DC, USN, and Lieutenant Robert J. Adams, DC, USN, U.S. Naval Medical Research Laboratory, New London, Conn. *Journal of Dental Research*, September–October 1959.

ELECTIVE CARDIOPLEGIA BY LOCAL CARDIAC HYPOTHERMIA. Lieutenant Harold C. Urschel, Jr., MC, USNR, Lieutenant Jack J. Greenberg, MC, USNR, and Charles A. Hufnagel, M.D., U.S. Naval Medical Research Institute, Bethesda, Md. *New England Journal of Medicine*, 24 December 1959.

U.S. NAVAL MEDICAL RESEARCH LABORATORY, U.S. NAVAL SUBMARINE BASE. Captain Joseph Vogel, MC, USN, U.S. Naval Medical Research Laboratory, New London, Conn. *A.M.A. Archives of Surgery*, October 1959.

MIMA POLYMORPHA MENINGITIS, REPORT OF A CASE AND REVIEW OF THE LITERATURE. Commander Charles L. Waite, MC, USN, and Lieutenant Allen H. Kline, MC, USNR, U.S. Naval Hospital, Jacksonville, Fla. *A.M.A. Journal Diseases of Children*, September 1959.

U.S. Air Force

AEROMEDICAL PROBLEM CASES, THREE YEARS' EXPERIENCE IN AVIATION MEDICINE CONSULTATION CENTER. Major Charles A. Berry, USAF, MC, and Captain Arthur H. King, USAF, MC, U.S. Air Force School of Aviation Medicine, Brooks Air Force Base, Texas. *Aerospace Medicine*, November 1959.

STUDIES OF PRIMATE TOLERANCE TO COMPLEX ACCELERATIONS. Captain Neville

P. Clarke, USAF, VC, and Captain Robert N. Headley, USAF, MC, Aerospace Medical Laboratory, Wright-Patterson Air Force Base, Ohio. *Aerospace Medicine*, November 1959.

DISLOCATION OF THE KNEE JOINT, Captain George L. Ford, Jr., USAF, MC, and J. Leonard Goldner, M.D., Shriners Hospital for Crippled Children, Greenville, S.C. *North Carolina Medical Journal*, November 1959.

OCCUPATIONAL HEALTH PROBLEMS IN SPACE FLIGHT. IMPORTANT HEALTH PROBLEMS IN THE MAN-IN-SPACE STUDIES AT THE AERO MEDICAL LABORATORY. George Kitzes, Ph.D., Aero Medical Laboratory, Wright-Patterson Air Force Base, Ohio. *Military Medicine*, October 1959.

DISORIENTATION IN FLIGHT, AN EVALUATION OF THE ETIOLOGICAL FACTORS. Colonel Ralph N. Kraus, USAF, MC, U.S. Air Force School of Aviation Medicine, Brooks Air Force Base, Texas. *Aerospace Medicine*, September 1959.

PRACTICAL THERAPEUSIS FOR NON-GONOCOCCAL URETHRITIS. Captain Clair E. Laidig, USAF, MC, USAF Hospital, Johnson Air Base, Japan. *Military Medicine*, November 1959.

A TECHNIQUE FOR DETERMINING CHANGES IN FORCE OF CARDIAC CONTRACTION DURING ACCELERATION. Captain Sidney D. Leverett, USAF, and Captain Neville P. Clarke, USAF, VC, Aerospace Medical Laboratory, Wright-Patterson Air Force Base, Ohio. *Aerospace Medicine*, November 1959.

PASSENGER PHLEBITIS, A COMPLICATION OF LONG DISTANCE AIR TRAVEL. Lieutenant Colonel Max J. Nareff, USAF, MC, USAF Hospital, Wiesbaden, Germany. *Aerospace Medicine*, November 1959.

ADULT PERICARDITIS AND MYOCARDITIS DUE TO COXSACKIE VIRUS GROUP B, TYPE 5. Captain Francis C. Null, Jr., USAF, MC, Veterans Administration Hospital, Salt Lake City, Utah, and C. H. Castle, M.D. *New England Journal of Medicine*, 5 November 1959.

FATAL DECOMPRESSION ILLNESS AT AN ALTITUDE OF 22,000 FEET. Major Lawrence T. Odland, USAF, MC, USAF Hospital, Johnson Air Base, Japan. *Aerospace Medicine*, November 1959.

EPIDEMIOLOGIC STUDIES OF HISTOPLASMIN SENSITIVITY. II. CONVERSION RATES. Harris D. Riley, Jr., M.D., U.S. Air Force Hospital, Sewart Air Force Base. Tenn. *American Practitioner & Digest of Treatment*, November 1959.

DIAGNOSIS OF LEFT-SIDED SUBPHRENIC ABSCESS. Captain Martin C. Rosner, USAF, MC, and Captain Morton A. Bosniak, USAF, MC, U.S. Air Force Hospital, Wimpole Park, England. *Journal of the American Medical Association*, 7 November 1959.

THE PRINCIPLES OF PULMONARY PHYSIOLOGY AS APPLIED TO CLINICAL MEDICINE. Lieutenant Colonel Robert B. Stonehill, USAF, MC, U.S. Air Force Hospital, Lackland Air Force Base, Texas. *American Practitioner & Digest of Treatment*, September 1959.

ROENTGENOLOGIC EVALUATION OF FLYING PERSONNEL AT SIMULATED ALTITUDE BY USE OF PORTABLE EQUIPMENT. Lieutenant Colonel Robert B. Stonehill, USAF, MC, Major Joel E. Reed, USAF, MC, and Captain Gerald W. Parker, USAF, MC, U.S. Air Force Hospital, Lackland Air Force Base, Texas. *Aerospace Medicine*, October 1959.

RHABDOMYOSARCOMA AND ITS RARE OCCURRENCE IN THE LOWER LIP. Major Andrew L. Tucker, USAF, MC, Baylor University College of Medicine, Houston, Texas. *Plastic & Reconstructive Surgery*, October 1959.

AGE, EXPERIENCE, AND AIRCRAFT ACCIDENTS. Anchard F. Zeller, Ph.D., Norton Air Force Base, Calif. *Aerospace Medicine*, October 1959.

This Is Your A.M.A.

AN OPINION SURVEY of physicians recently separated from active military service has been conducted by the Council on National Security of the American Medical Association since 1952. Data based on the physician's experiences, observations, and opinions are solicited by means of a questionnaire. Also requested are the physician's suggestions and comments as to further improvement of military medical services and means whereby civilian medicine can be of greater assistance to military physicians.

This report covers the period from 1 January 1958 to 31 December 1958. During that period, the Council sent out 1,346 questionnaire forms. Of these, 730 completed forms were returned, representing a 54.2 percent response.

Age Distribution

The age distribution of responding physicians in the Army, Navy, and Air Force is disclosed in table 1.

Table 1. ***Age distribution of physicians by 5-year age groups***

Age (years)	*Army*	*Navy*	*Air Force*
25–29	100	13	107
30–34	161	27	115
35–39	101	4	32
40–44	46	1	7
45–49	1	–	1
50 and over	9	2	3
Total	418	47	265

Table 2. ***Number and percentage distribution of physicians graduated from medical schools in selected intervals***

Interval	*Number*	*Percent*
Before 1940	10	1.4
1940–1944	56	7.7
1945–1949	130	17.8
1950–1955	531	72.7
1956 and later	1	0.1
No reply	2	0.3
Total	730	100.0

Table 3. ***Number and percentage distribution of physicians by years of residency***

Number of years	*Number*	*Percent*
None	176	24.1
1	184	25.2
2	149	20.4
3	102	14.0
4	58	7.9
5	22	3.0
6	13	1.8
No reply	26	3.6
Total	730	100.0

From the Council on National Security of the American Medical Association. The views and opinions expressed are not necessarily those of the Department of Defense.—EDITOR.

Date of Graduation

More than half of the physicians replying to the question on years since graduation were graduated from medical school subsequent to 1949 (table 2). The second largest group graduated during the period 1945–1949. Only 2 physicians failed to indicate the years of graduation from medical school.

Years of Residency Training

The largest group replying to the question on years of residency training had 1 year of residency training, while the second largest group had no residency training at the time of entrance on active military duty. A complete breakdown is given in table 3.

Occupation at Time of Entering Service

The largest groups of physicians who served in the Army, Navy, and Air Force were in internship at the time of entrance on active military duty. The second largest group in the Army was in specialty practice, while the second largest groups in the Navy and Air Force were in residency training. Table 4 indicates the percentage distribution by services according to type of practice at time of entering military service. The summary report for the year 1957 showed that the largest groups in all 3 services were in residency training at the time of entrance into active military duty.[1]

Table 4. ***Percentage distribution of 730 physicians according to type of practice at time of entering military service***

Occupation	*Army (percent)*	*Navy (percent)*	*Air Force (percent)*
Internship	27.6	59.6	34.7
Residency training	19.9	14.9	26.8
General practice	19.6	8.5	13.2
Specialty practice	22.2	10.6	12.1
Other	10.5	4.3	12.8
No reply	0.2	2.1	0.4
Total	100.0	100.0	100.0

Board Certificates

Table 5 shows the number, by specialty and branch of service, of physicians holding board certificates. Of the 106 physicians who have board certificates, 73 were in the Army, 4 were in the Navy, and 29 were in the Air Force. The specialties covered more than 17 different fields, of which the largest was surgery (18). The second largest was internal medicine (17). In the report for the year 1957, internal medicine and surgery were first, followed by radiology and pediatrics.[1] By branch of service, a total of 17.5 percent of those in the Army, 8.5 percent of those in the Navy, and 10.9 percent of those in the Air Force had specialty board certificates.

Table 5. ***Number of physicians holding board certificates by field of specialization***

Field of specialization	*Army*	*Navy*	*Air Force*
Pediatrics	6	–	3
Psychiatry and neurology	4	–	3
Orthopedic surgery	3	–	1
Dermatology & syphilology	2	1	1
Radiology	5	–	3
Urology	2	–	–
Obstetrics and gynecology	5	–	2
Internal medicine	13	–	4
Ophthalmology	1	–	2
Pathology	4	–	3
Otolaryngology	1	–	–
Surgery	12	2	4
Anesthesiology	2	–	–
Plastic surgery	1	–	–
Neurological surgery	2	–	–
Preventive medicine & public health	1	–	–
Thoracic surgery	1	–	1
Unspecified	8	1	2
Total	73	4	29

Government Medical Education Received

Of the 730 physicians responding, a total of 63 stated that they had received assistance from the Federal Government in their medical education. There were 667 who indicated they had received no Government assistance. The largest single group receiving Government assistance was under the Army Specialized Training program. The next 2 largest groups were under the Navy V–12 program and the GI program.

Table 6 shows the percentages by branch of service. Of the responding physicians, 91.4 percent of those who served in the Army, 89.4 percent of those in the Navy, and 91.7 percent of those in the Air Force received no Government assistance.

Table 6. ***Percentage distribution of physicians by type of government medical education received***

Training	*Army (percent)*	*Navy (percent)*	*Air Force (percent)*
Army Specialized Training program	36.1	–	22.7
Navy V–12	13.9	–	22.7
GI Bill	13.9	40.0	18.2
ASTP and GI Bill	5.6	–	–
Navy V–12 and GI Bill	8.3	20.0	9.1
Other	22.2	40.0	27.3
Total	100.0	100.0	100.0

Training Received While in Service

There were 543 of a total of 730 responding physicians who received military medical training while on active duty in the Army, Navy, and Air Force. Thirty-four Army, 30 Navy, and 114 Air Force physicians replied that they had received no such training. Nine physicians did not reply to this question. The medical field service school accounted for the largest number, with the school of aviation medicine the second largest group. Table 7 sets forth the number and percentage distribution of physicians by type of training received in each branch of service. The totals in this table exceed the total number of responding physicians because some physicians took more than one course.

Physicians' Evaluation of Military Training

The majority of physicians who completed the questionnaire thought that all important features of military training had been satisfactorily covered. A small

Table 7. ***Number and percentage distribution of physicians by type of government medical training received***

Type of training	*Army*		*Navy*		*Air Force*	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Basic course, medical field service school	379	88.4	3	5.4	49	18.2
Advanced courses, medical field service school	9	2.1	–	–	–	–
School of aviation medicine	6	1.4	5	9.1	106	39.4
Marine medical officers training	–	–	3	5.5	–	–
Marine field service training	–	–	5	9.1	–	–
Amphibious forces training school	1	0.2	9	16.4	–	–
None of the above	34	7.9	30	54.5	114	42.4
Total	429	100.0	55	100.0	269	100.0

Table 8. ***Physicians' evaluation of military training***

Evaluation	*Army (percent)*	*Navy (percent)*	*Air Force (percent)*
Satisfactory	76.6	74.5	76.6
Unsatisfactory	20.1	25.5	17.7
No reply	3.3	–	5.7
Total	100.0	100.0	100.0
Unsatisfactory and insufficient training in:			
Basic orientation and indoctrination	29.4	38.4	29.7*
Military customs, administration, regulations, et cetera	32.3	38.5*	25.9
Military medicine and surgery	20.6	15.4	18.5
Miscellaneous	15.7	7.7	22.2
No reply	2.0	–	3.7
Total	100.0	100.0	100.0

*Forced to total 100 percent.

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percentage indicated that the training was unsatisfactory but gave no specific reasons. Others stated reasons why they considered their military training unsatisfactory. A few did not reply to the question. Table 8 shows, by branch of service, the percentage distribution of satisfied and unsatisfied and the percentage distribution of the causes of dissatisfaction.

Evaluation of Assignment

The majority of responding physicians stated that their longest and next longest assignments were almost completely in line with their training and experience.

Table 9. ***Relation of assignments in the service to training and experience***

Questions and replies	*Army (percent)*	*Navy (percent)*	*Air Force (percent)*
Was longest assignment in line with training and experience?			
Almost completely	64.8	61.7	64.0
Partially, but satisfactorily	19.3	17.0	21.2
Partially, not satisfactorily	10.1	10.6	12.5
No, hardly at all	5.8	10.7*	2.3
Total	100.0	100.0	100.0
Was next longest assignment in line with training and experience?			
Almost completely	61.9	64.7	58.0
Partially, but satisfactorily	17.1	17.7*	23.2
Partially, not satisfactorily	11.9	14.7	7.2
No, hardly at all	9.1	2.9	11.6
Total	100.0	100.0	100.0

*Forced to total 100 percent.

Table 10. ***Physicians' satisfaction with assignment***

Assignment and response	*Army (percent)*	*Navy (percent)*	*Air Force (percent)*
Longest assignment			
Very satisfied	47.5*	34.0	44.7
Fairly satisfied	32.8	40.4	38.5
Dissatisfied	13.6	19.2*	9.2
Very dissatisfied	6.1	6.4	7.6
Total	100.0	100.0	100.0
Next longest assignment			
Very satisfied	49.4	35.3	50.0
Fairly satisfied	26.3	44.1	25.4
Dissatisfied	13.9	17.7*	14.5
Very dissatisfied	10.4	2.9	10.1
Total	100.0	100.0	100.0

*Forced to total 100 percent.

With respect to satisfaction with assignments, a greater proportion of the Army and Air Force physicians expressed satisfaction concerning their longest assignments than did Navy physicians, while a larger percent of the latter group was satisfied with the next longest assignment. Tables 9 and 10 show the percentages by branch of service for physicians who responded to this question.

Types of Patients Treated

One of the questions was designed to determine the percentage of time devoted by physicians to military personnel, dependents of military personnel, and administrative duties, both at domestic and overseas stations. Table 11 sets forth the percentages for all branches of service.

Table 11. ***Percentage of time spent in treating military personnel, dependents of military personnel, and other duties***

Persons treated	*75–100 percent*	*50–75 percent*	*About 50 percent*	*25–50 percent*	*Under 25 percent*	*No response*
Military personnel						
Domestic	18.2	9.6	13.4	11.9	17.0	29.9
Overseas	15.5	4.0	8.9	6.3	7.4	57.9
Dependents of military personnel						
Domestic	17.8	7.5	13.6	11.8	19.6	29.7
Overseas	6.8	3.4	8.8	7.0	10.4	63.6
All other duties						
Domestic	9.7	0.7	1.0	4.9	25.8	57.9
Overseas	2.1	1.4	0.8	3.5	15.9	76.3

Table 12. ***Type of service provided to dependents of military personnel***

Type of service	*Army (percent)*	*Navy (percent)*	*Air Force (percent)*
Domestic			
Outpatient care	36.7	42.7	31.4
Surgery	13.7	8.5	10.7
General medical and hospital care	16.4	8.6*	15.4
Obstetrics and gynecology	11.1	14.6	18.1
Pediatrics	11.8	18.3	17.9
Other	10.3	7.3	6.5
Total	100.0	100.0	100.0
Overseas			
Outpatient care	37.0	27.3	31.8
Surgery	12.3	15.2*	8.8
General medical and hospital care	13.4	15.1	17.5
Obstetrics and gynecology	13.4	12.1	14.7
Pediatrics	15.4*	21.2	21.2
Other	8.5	9.1	6.0
Total	100.0	100.0	100.0

*Forced to total 100 percent.

Types of Nonmilitary Medical Care Provided

The question that was designed to determine the types of medical duties most frequently performed for nonmilitary persons elicited the information that in all 3 of the armed services outpatient care ranked first at domestic and overseas stations. In the Army, general medical and hospital care ranked second at domestic stations and pediatrics ranked second overseas. In the Navy, pediatrics was second at both domestic and overseas installations. Obstetrics and gynecology was second for Air Force physicians in the United States while pediatrics ranked second overseas. Table 12 sets forth the types of services rendered and with what frequency.

Medical Care of Dependents of Military Personnel by Civilian Medical Personnel

With respect to service in the United States, the majority of responding physicians were of the opinion that all medical care of nonmilitary persons could have been adequately performed by civilian medical personnel. In the 3 armed services, 294 of 537 physicians (55 percent) so responded. However, in regard to overseas service, only 71 of 288 physicians (25 percent) were of that opinion. In fact, 113 of 288 physicians (39 percent) stated that none of the medical care of nonmilitary persons at overseas stations could have been adequately performed by civilian medical personnel. Table 13 shows the percentages of physicians in the Army, Navy, and Air Force and their opinion in regard to the feasibility of the treatment of dependents of military personnel by civilian medical personnel at both domestic and overseas bases.

Table 13. ***Physicians indicating feasibility of medical care of nonmilitary personnel by civilian medical personnel***

Type of service	*Army*		*Navy*		*Air Force*	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Domestic						
All care	143	50.5	26	61.9	125	59.0
Most care	60	21.2	7	16.6	41	19.3
Some care	59	20.9	7	16.7*	39	18.4
None	21	7.4	2	4.8	7	3.3
Total	283	100.0	42	100.0	212	100.0
Overseas						
All care	40	22.3	5	35.7	26	27.4
Most care	32	17.9	1	7.1	11	11.6
Some care	34	19.0	2	14.3	24	25.2
None	73	40.8	6	42.9	34	35.8
Total	179	100.0	14	100.0	95	100.0

*Forced to total 100 percent.

The concluding part of this report will appear in the May issue of the *U.S Armed Forces Medical Journal.*

REFERENCE

1. Message from the A.M.A. *U.S. Armed Forces M.J.* 10: 371–374, March 1959.

Book Reviews

PRINCIPLES OF BIOCHEMISTRY, by *Abraham White*, Ph. D., *Philip Handler*, Ph. D., *Emil L. Smith*, Ph. D., and *DeWitt Stetten, Jr.*, M. D., Ph. D. 2d edition. 1,149 pages; illustrated. The Blakiston Division, McGraw-Hill Book Co., Inc., New York, N.Y., 1959. Price $15.

The authors of this text, who represent a superb cross section of contemporary authorities in the field of biochemistry, have presented an extraordinary text based on their combined professional and teaching experience, with the discussion coordinated between the authors and their associates. The subject matter is divided into 7 parts that are logical in sequence and content. These cover composition of living matter, enzymes, metabolism, body fluids and electrolyte balance, specialized tissues, the biochemistry of the endocrines, and nutrition. In the overall presentation, emphasis is placed on the dynamic aspects of biochemistry, such as catalysis, biologic oxidative systems, and metabolism. This brings to the reader a study of the principles of biochemistry based on concepts of inorganic, organic, and physical chemistry. The numerous tables and figures throughout the text and direct references to the literature capably support the technical presentations. The book is an excellent text for the student and an up-to-date handy reference for the professional man who requires comprehensive information on biochemical processes. It is well organized and worded, and even a person experienced in this field will find much ready information in the numerous charts, figures, and tables. LT. COL. WILLIAM H. LEE, USAF, MSC

NURSING OF CHILDREN, by *Robert A. Lyon*, M.D., and *Elgie M. Wallinger*, R.N., B.S., M.A. 5th edition. 554 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $5.

This book for nurses, written by a physician and a nurse, contains the most recent knowledge of both professions combined into a single vehicle for easy reading. It is most remarkably up to date. One must study it thoroughly to find any still controversial remarks stated as fact. The authors have carefully attempted to eliminate most opinions regarding child health that are not scientifically accurate according to present-day knowledge. This is reassuring for the physician, who often finds that the nurse's concept of a particular disease is somewhat out of date. The book is written in the form of a complete textbook of pediatrics. Most diseases are discussed. The earlier chapters deal with such general subjects as growth and development, nutrition, and the care of the sick child. A chapter on therapeutic procedures carries in it many good ideas for accomplishing nursing tasks. Temperature taking, restraints, enemas, treatments, and many other subjects, are well described. The last half of the book contains chapters on specific diseases commonly encountered in the office as well as in the hospital. The discussion of each disease is followed by a paragraph listing the usual nursing procedures that may be expected by the doctor. Reasons are given for the importance of these procedures. This arrangement makes it possible for a nurse to use the book as a guide or reference when new disease situations are encountered. The book is pleasant to read and well organized. It should be available to all nurses who specialize in nursing care of children, whether in the office, clinic, or hospital. CAPT. THOMAS A. HANSON, MC, USA

THE ANNUAL SURVEY OF PSYCHOANALYSIS, A Comprehensive Survey of Current Psychoanalytic Theory and Practice. Volume V, edited by *John Frosch*, M.D., and *Nathaniel Ross*, M.D. *Lottie M. Newman*, editorial assistant. 608 pages. International Universities Press, Inc., New York, N.Y., 1959. Price $12.

This book is extremely valuable for anyone interested in or practicing psychoanalysis. It is likewise of use to psychologists, anthropologists, and sociologists who use psychoanalytic principles. It is well ordered and well written. The major contributions to the literature on psychoanalysis over the past few years are well and interestingly covered. The book is recommended only for libraries where psychiatric service exists and for those who might be specifically interested in the field of psychoanalysis. LT. COL. PAUL F. EGGERTSEN, USAF, MC

THE YEAR BOOK OF CANCER (1958–1959 Series), compiled and edited by *Randolph Lee Clark, Jr.*, B.S., M.D., M. Sc. (Surgery), D. Sc. (Hon.), and *Russell W. Cumley*, B.A., M.A., Ph. D. 569 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., 1959. Price $8.

This edition of the Year Book of Cancer is logically arranged by organ systems and special tumor types. Individual chapters consider such aspects as chemotherapy and hormone therapy, roentgen diagnosis, epidemiology, terminal care, and recent experimental advances through various approaches. The paper is good; the type and illustrations clear. Since all aspects of cancer are covered, there is much that will not interest specialists other than oncologists. The articles abstracted have been carefully chosen and those considered to be particularly important have been given more complete coverage and editorial comment than one gets in the ordinary abstract. There are, however, plenty of individual case reports and statistical studies. These statistical evaluations make heavy going and are difficult to assimilate in an abstracted form. The individual case reports and the reports of the bizarre and the unusual cause one to consider that perhaps there is not sufficient really significant work in the cancer field in the course of a year to justify so extensive a publication. Perhaps it could be improved by further restricting the number of articles abstracted and expanding even further the review of truly significant work. A book of this nature is out of date before it is printed, as demonstrated by the failure to mention the isolated perfusion of extremities with blood containing large amounts of cancericidal drugs. This work was reported since the book went to press and constitutes knowledge the truly informed physician should now have. The Year Book of Cancer is recommended for browsing in order to call one's attention to important work one has missed in the past year. It should be on the shelves of all medical libraries, primarily as a reference work and as an invitation to the busy physician to consider investigative research work that does not usually appear in the specialty journals. LT. COL. DAVID E. THOMAS, MC, USA

COMBINED TEXTBOOK OF OBSTETRICS AND GYNAECOLOGY, for Students and Practitioners, edited by *Dugald Baird*, B. Sc., M.D., D.P.H., F.R.C.O.G. 6th edition. 936 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $15.

The sixth edition of this book has been rewritten to bring it into clearer focus with many of the recent advances in obstetrics and gynecology, and yet the total number of pages has been reduced. By maintaining both branches of this specialty in a single text, the editor continues to present a logical path of learning, without

being repetitious or resorting to flashbacks. The resulting format moves from anatomy, through physiology, into normal obstetrics in a smooth and uncomplicated manner, although it might have been better to include embryologic malformations in early rather than later sections of the book. Having clearly established the norms, the text continues on into obstetric pathology and gynecology. Although the section on family planning, too frequently overlooked in our American texts, is welcome, the details are not sufficiently developed to familiarize the reader fully with each contraceptive technic. A section devoted to the psychologic aspects of the specialty is worth reading for anyone even remotely associated with obstetrics or gynecology. Too many students are not properly indoctrinated in this subject and an unknown number of patients must suffer until this deficiency is corrected. Few other specialties require the working knowledge of emotional and tension problems imposed by our specialty. A chapter devoted to medicolegal considerations, although of lesser value to American readers than to our English colleagues, makes fascinating reading. Some of the possibilities raised in the discussion of therapeutic abortion are not only thought provoking, but frightening. The last portion of the book, devoted to gynecologic operations, was not constructed to supplant the more inclusive texts on the subject. The author presents only the more common procedures and gives only the basic details. Although this idea has been used in some of our American texts, it should be given more adequte attention. In fact, the present book could better prepare the student by being a little more selective and descriptive in each of the important steps of these procedures. The only real deficiency of this book is one inherent in any foreign text—many of the drugs recommended require conversion into American trade names. It is unfortunate that this was not accomplished by the use of parentheses, for it would make this excellent book more valuable to those in the United States. It may be noted that the editor carefully avoids becoming involved in some of the newer, more controversial issues in obstetrics, such as postmaturity. He certainly is to be congratulated for this decision, in this type of book, when one considers the positive ideas of many of his prominent colleagues. The book is durably constructed, excellent paper is used, and the printing is clear and easy to read. As with many English texts, it is a pleasure to read because of the many idioms used, the wry sense of humor displayed, and the clear, effortless manner of presentation. The combined textbook can be highly recommended to students and general practitioners, for whom it is ideally suited. They will find not only that it presents the subject by a more logical approach than they have hitherto encountered in American texts, but that it reads more like a novel than a textbook.

LT. COL. WILLIAM F. PETERSON, USAF, MC

CHEMICAL QUANTITATION OF EPINEPHRINE AND NOREPINEPHRINE IN PLASMA, Their Plasma Concentration in Hypertension, Shock and Mental Disease, With Some Metabolic Studies, by *William Muir Manger*, B.S., M.D., Ph. D.; *Khalil G. Wakim*, M.D., Ph. D.; and *Jesse L. Bollman*, M.D. 389 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $11.50.

Appearing only 3 years after the edition of Von Eulers' classic monograph on norepinephrine by the same publisher, this volume is a welcome and necessary follow-up on applied physiology and clinical pathology of the epinephrines. The interest is focused on the sympathoadrenal hormones from several directions and the authors have made a large contribution to the available data in this rapidly growing field, especially by plasma level determinations of epinephrine and

norepinephrine in hypertension and mental disease. The sensitivity necessary for determining the small amounts of catecholamines in blood is achieved by fluorometric methods, especially the method of Weil-Malherbe and Bone, which permit the simultaneous determination of epinephrine and norepinephrine through the use of filters. The authors find that sodium thiosulfate differentially affects the development of fluorescent condensates of epinephrine and norepinephrine and compare this modification with the use of secondary filters. Determining the range of peripheral venous plasma concentrations of epinephrine and norepinephrine in healthy men and women, they found epinephrine to range from 0 to 1 μg per liter of plasma for men, and 0 to 1.6 μg per liter for women, and norepinephrine from 0.4 to 8.8 μg per liter for men and 0.1 to 3.8 μg per liter for women. In essential hypertension the levels of pressor amines did not differ significantly from normal values. Pheochromocytoma, though rare, is a definite diagnostic and therapeutic challenge, and analysis of 23 cases by the authors permits some practical conclusions, the data being analyzed according to whether hypertension was sustained or paroxysmal. Of importance is the recommendation to do at least two plasma determinations of pressor amines, one during or soon after a spontaneous paroxysm, and one during a paroxysm precipitated by histamine as part of the diagnostic work-up. The 24-hour urine catecholamine levels occasionally were within normal limits, while plasma determinations, following provocative tests, permitted positive diagnosis of pheochromocytoma. For screening purposes a single measurement of the fluorescence given by both epinephrine and norepinephrine expressed as epinephrine-like material was employed by the authors in a number of disorders. Metastatic lymphoma, increased intracranial pressure, certain brain tumors, and some cases of periarteritis nodosa were associated with increased plasma concentrations of epinephrine-like substances. The chapters on shock and metabolic studies are more in the field of research but are stimulating even for those with a primary interest in clinical fields. The authors confirm the data of Watts regarding hemorrhagic shock, although their own experiments should more properly be called hemorrhagic hypotension. This condition is associated with the rapid rise of epinephrine levels in peripheral plasma. The text is not easy reading and takes the student into a great variety of rather specialized fields. It is based on a great number of references and personal communications as much as on original data. It is expected that the various chapters will appeal to as many groups with special interest in the physiology and pathology of the epinephrine-like substances, and that the book will serve as an excellent reference work.

LT. COMDR. JENÖ E. SZAKÁCS, MC, USN

A SYNOPSIS OF SKIN DISEASES, by *Bethel Solomons, Jun.*, M.A., M.D., F.R.C.P.I. 294 pages. Williams & Wilkins Co., Baltimore, Md., 1959. Price $6.75.

This book on skin diseases is one of several in the synopsis series published in Great Britain. The author has done an outstanding job in presenting the essentials of the more important skin diseases. A brief but adequate outline of anatomy, physiology, general aspects of etiology, pathology, symptomatology, diagnosis, and treatment opens the book. Each skin disease is discussed in a brief but informative manner following this format. In addition to the excellent material in the manuscript proper, the appendix contains a valuable table for patch testing, a useful formulary, and an index that makes ready reference an easy task. The author intended this book for busy practitioners and for those reviewing for examinations; however, any physician interested in dermatology will find this text a valuable addition to his personal library.

COL. ALLEN D. SMITH, USAF, MC

COLOR ATLAS AND MANAGEMENT OF VASCULAR DISEASE, by *William T. Foley*, M.D., F.A.C.P., and *Irving S. Wright*, M.D., F.A.C.P. 170 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N.Y., 1959. Price $18.

The authors of this book have compiled an excellent collection of well-selected color photographs illustrating every major type of vascular disease. Even though much has been written on the subject in the past, this is probably the first complete color atlas depicting the various changes seen as a result of these circulatory diseases. Color changes observed in the various peripheral vascular diseases are most important to the practicing physician if an accurate diagnosis is to be established and appropriate therapy administered. The color photographs utilized in this book demonstrate these changes in an outstanding manner. Color illustrations prove much more effective in depicting these changes than a detailed narrative and black and white photographs. The case histories presented and illustrated in this atlas have been well selected. Signs, symptoms, pathogenesis, differential diagnosis, prognosis, complications, and treatment of the various vascular diseases are briefly and concisely discussed. Most of the cases described were treated conservatively, but in a few, radical surgical measures were utilized. Specific details of the surgical technics used are not included in this atlas. The book is well edited, is easily read and understood, and demonstrates an excellent clarity of presentation. The table of contents and index are brief, concise, and accurate. The color and trophic changes seen in the various types of vascular disease are vividly demonstrated by the color photographs and brief descriptions. Although not written as a reference textbook in this specialized field, the book will prove to be a valuable addition to the medical libraries of all general practitioners, internists, cardiologists, medical schools, and hospitals. Even though the specific details of the surgical technics are not described, it is believed that this atlas will also prove to be of interest and value to surgeons.

CAPT. RALPH D. ROSS, MC, USN

AUTOGENIC TRAINING, A Psychophysiologic Approach in Psychotherapy, by *Johannes H. Schultz*, M.D., and *Wolfgang Luthe*, M.D. 289 pages; illustrated. Grune & Stratton, Inc., New York, N.Y., 1959. Price $9.50.

This book is a description of a psychotherapeutic method practiced largely in Germany. The method outlined suggests a blend of Jacobson's progressive muscular relaxation, Coućism, and yoga. The average American psychiatrist, especially of the group referred to by Redlich as the "analytic-psychological," is likely to respond to a cursory scanning of the book with a distinctly skeptical reaction. The approach delineated is foreign to our current thinking about psychotherapy and even seems to carry a suggestion of unscientific cultism. Autogenic training is a method of treating a wide variety of neurotic and psychosomatic (but not psychotic) disorders through a careful regimen of more or less supervised autosuggestion exercises. For some patients, these exercises are apparently curative and for others they are adjunctive to other more "conventional" methods of treatment. The book is written by two German physicians. The senior author has been engaged in researching and developing this method for about 40 years. There is a bibliography of over 400 titles, most of them published in the past 10 years and practically all in West Germany. The method seems to be taken very seriously indeed by German psychiatry. The therapeutic results, as represented, are impressive. It is the reviewer's opinion that this book should be read thoughtfully and with an open mind.

CAPT. CHARLES S. MULLIN, MC, USN

EXPERIMENTAL SURGERY, Including Surgical Physiology, by *J. Markowitz*, M.B.E., M.D. (Tor.), Ph.D., M.S. in Exp. Surg. (Minn.); *J. Archibald*, D.V.M., M.V.Sc., Dr. Med. Vet. (Giessen), M.R.C.V.S.; and *H. G. Downie*, D.V.M., M.S. (Cornell), M.V.Sc. 4th edition. 931 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $12.50.

Delightfully written and appropriately sprinkled with pertinent classic and not-so-classic passages, this new edition includes a discussion of laboratory equipment, problems related to the antivivisectionist movement, and animal care preceding the main subject matter of the book. In general, the subjects are taken up by organ system, with occasional detours into special experimental and clinical problems related to a particular organ system or systems, such as chronic peptic ulcer, intestinal obstruction, transplantation, cardiac arrest, and hypothermia. The detailed descriptions of the creation of certain animal preparations in the experimental operating room for the study of physiologic problems are exhaustive. The coverage of surgical procedures on the stomach and intestine, the authors' approach to the hypophysis, and the preparation of the isolated heart set-up are particularly well done. One should not expect detailed clinical application of the experiments, although such application is stressed when pertinent. The discussion of the clinical application is, however, not the strong point of this book. One should also not expect information regarding more recently devised instruments and media for experimental mensuration. If, on the other hand, the reader would desire to set up a Mann-Williamson dog preparation, he will be instructed in the procedure to the most minute detail. Hundreds of animal preparations are similarly described in these pages. Of value as a reference volume not only to the neophyte in surgery but to the investigator who must be aware of the surgical possibilities in his study, the book is rich in the historical background of the study of physiology through experimental surgery. A relatively detailed bibliography is appended to each chapter. Above all, the style is refreshing and allows for easy, understandable, and pleasant reading.

LT. COL. THOMAS J. WHELAN, MC, USA

SYNOPSIS OF OPHTHALMOLOGY, by *William H. Havener*, B.A., M.D., M.S. (Ophth.). 288 pages; illustrated. C. V. Mosby Co., St. Louis, Mo., 1959. Price $6.75.

No specialty in medicine has produced more voluminous literature per unit of tissue than ophthalmology. This has, without doubt, occasionally appalled or confused the worried resident or physician seeking quick information regarding a patient with an ophthalmologic problem. In this synopsis, Dr. Havener provides chapter headings and titles that quickly lead his reader to the information he seeks. For example, his chapter on diagnosis and management of the "red eye" gives the reader basic information on external and internal eye diseases and on systemic conditions in which the red eye is an objective finding. This would be impossible in a more complete text having separate chapters on conjunctivitis, iritis, and general diseases such as dermatologic or allergic conditions. The advice the author gives concerning therapy is sound and in consonance with current ophthamologic thinking. He repeatedly emphasizes to his readers the need for close cooperation between the ophthalmologist and his medical colleagues, whether they are specialists or general practitioners. His concise descriptions are well written and sufficiently interesting to lead the resident to further study after the emergency period has passed. In closing his book the author points out the value of proper medical care (often that rendered first, by the nonspecialist) in preventing many of the 27,000 new cases of clinical blindness occurring in the United

States each year. This synopsis has been excellently prepared, and printed in handbook size. A number of the illustrations, particularly those of intraocular conditions, are not of the best quality. In future editions, the use of color plates would enhance the value of the synopsis. Using the words of the author in his preface, this synopsis presents the practical viewpoint of the practicing ophthalmologist to help physicians in the diagnosis and management of eye diseases. It is highly recommended, especially to residents and practitioners desirous of a ready reference in ophthalmologic diagnosis and therapy.

COL. RICHARD S. FIXOTT, USAF, MC.

EARLY DIAGNOSIS, by various authors, edited by *Henry Miller*, M.D., F.R.C.P. 400 pages. Williams & Wilkins Co., Baltimore, Md., 1959. Price $6.50.

This little monograph by a number of British authors is a group of essays on the early recognition of important diseases. In general, the diseases selected for discussion are those in which early treatment is vital and for many of which there is a very satisfactory method of therapy. The most glaring omission from the conditions discussed is tuberculosis, in which early diagnosis is so important and on which so much emphasis has been placed by U.S. authors. The book is slanted to the general practitioner, with maximum emphasis on clinical observations based on history, symptoms, and signs. There is minimum discussion of elaborate, expensive laboratory procedures, especially those requiring hospitalization. In all of the essays liberal use is made of therapeutic tests in arriving at a diagnosis. The English style of writing of this most readable little volume is refreshing. Some differences between British and U.S. usage are apparent; for example, "rigor" is used in place of "chills" and the more complex English spelling is used. The busy practitioner will want a more complete answer than that given in most of these little essays. When he stops to review or perform research on a question of early diagnosis, he will probably want a more complete list of conditions and more complete coverage.

COL. WILLIAM D. PRESTON, USAF, MC

A SYNOPSIS OF ANAESTHESIA, by *J. Alfred Lee*, M.R.C.S., L.R.C.P., M.M.S.A. F.F.A.R.C.S., D.A. 4th edition. 616 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $6.50.

This well-known synopsis, now appearing in its fourth edition, has been completely revised and altered to compensate for the changes in theory and practice that have occurred during the past 5 years. Many illustrations have been added, dealing largely with advances in anesthetic equipment. New chapters have also been added: one on the phenothiazine derivatives and one on induced hypothermia, and there is a new section on Fluothane. For those not acquainted with the earlier editions, this book contains a wealth of information beginning with the history and anatomy involved and continuing through all agents, technics, apparatus, indications, and sequelae. It is intended to serve as a ready reference rather than to replace larger textbooks. Specific references are given conveniently at the foot of the page, rather than in the form of a terminal bibliography. The index appears complete. The discussions of drugs point up the hopelessly involved terminology and indicate the pressing need for a simple international nomenclature. To be obliged to encompass 5 to 8 names for many of the drugs is a totally hopeless undertaking. This synopsis may be highly recommended particularly to students, residents, and those preparing for examinations. In addition it is of continuous value to all who practice anesthesiology.

COL. JOHN F. KELLOGG, JR., MC, USA

YEAR BOOK OF ENDOCRINOLOGY (1958–1959 Year Book Series), edited by *Gilbert S. Gordan.* M.D., Ph. D., F.A.C.P. 384 pages; illustrated, Year Book Publishers, Inc., Chicago, Ill., 1959. Price $7.50.

This year book continues to justify itself as a volume separate from the Year Book of Medicine, although the latter contains sections on all other usual subspecialties of internal medicine, including one on metabolism. If the recent advances in endocrinology leave the editor of 8 years "a little breathless," as he states, consider how these advances and the complexities of some of the original articles (read by this reviewer) would deter many internists from keeping abreast of this field! Yet this book of well-selected, clearly written abstracts with numerous pithy, critical, and imaginative editorial comments should achieve its aim of keeping the general internist and those in allied specialties well informed. Only a few of the major advances can be enumerated here: elucidation of the factors controlling the secretion of aldosterone; distinction of a genetic female from a genetic male; preparation of an effective pituitary growth hormone; discovery that antibodies to thyroglobulin are detectable serologically, and even by skin test, not only in patients with Hashimoto's disease but also in those with "idiopathic" myxedema, strongly suggesting that the latter is often the result of thyroidal atrophy induced by an autoimmune mechanism; greatly increased knowledge of calcium metabolism, especially by means of radioisotopes; better detection of hyperparathyroidism; recognition of the practical importance and efficacy of treating certain hypercalcemic states with adrenal corticosteroids; growing acceptance of the hypoglycemic sulfonamides—carbutamide and tolbutamide—and more recently of chlorpropamide, metahexamide, and the chemically unrelated diguanides, all of which have greatly accelerated basic and clinical investigation of diabetes mellitus and have added immeasurably to the safe control of this disease; and clear indication for cortisone treatment of congenital virilizing adrenocortical hyperplasia, while recognizing that similar treatment of simple hirsutism in girls has been too indiscriminate. This book is highly recommended for internists and allied specialists.

CAPT. H. LEONARD JONES, MC, USN

OPEN REDUCTION OF COMMON FRACTURES, by *Oscar P. Hampton, Jr.*, M.D. F.A.C.S., and *William T. Fitts, Jr.*, M.D., F.A.C.S. 212 pages; illustrated. Grune & Stratton, Inc., New York, N.Y., 1959. Price $8.75.

In this small but meaty volume the authors have discussed the fractures that they believe are best treated by open reduction when conditions are optimum. They hasten to add that it is not the method of choice if the surgeon is not experienced in bone and joint surgery; if a completely equipped operating room is not available; or if infections are rampant in the hospital. They take issue with the common use of the term "conservative" to denote the closed or nonoperative treatment, pointing out that the term properly means "to preserve." In fact there are many situations in which preservation of optimum function demands operative intervention. The indications for open reduction in each fracture are discussed and there is a brief description of the operative technic. The descriptions of the surgical approaches and the technics of fixation are rather brief and sketchy for the inexperienced surgeon or student, and the experienced orthopedist would rarely need this help. The discussions are confined to well-accepted material with careful avoidance of the controversial. The book should appeal to surgical and orthopedic residents, and to the general surgeon whose practice includes a generous amount of surgery of trauma.

CAPT. WILLIAM S. STRYKER, MC, USN

CUTANEOUS MANIFESTATIONS OF THE MALIGNANT LYMPHOMAS, by *Samuel M. Bluefarb*, B.S., M.D., F.A.C.P. 534 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $15.50.

This monograph, one in the American Lecture Series on the reticulo-endotheliosses, represents a summation of the author's 15 years' interest in the 3 subjects presented; mycosis fungoides, Hodgkin's disease, and lymphosarcoma. It is the author's opinion that "there may be some constructive value in collecting and correlating representative examples of the cutaneous manifestations and observations on the natural history of these diseases" and that this material "may be of some diagnostic aid, and more important, may possibly suggest new methods of approach to the clarification of the heretofore obscure knowledge regarding the origin and clinical course of lymphomatous diseases." Unfortunately, such a labor of love appears to have fallen short of its expressed goals. The voluminous material in the monograph appears to have been neither selectively nor critically integrated. The recitation of long case reports and the inclusion of interesting, but frequently not entirely germane, data serve to obscure rather than to elucidate the varied facets of these entities. Treatment modalities of dubious value, interesting only in a historic sense, are dealt with at some length, frequently vying in commentary with those of some proved palliative worth. Confusion must of necessity arise in the mind of the reader who is less than sophisticated or not hypercritical. The photographs appear to have been poorly chosen. The absence of more than 2 color plates in the frontispiece must also be considered a major shortcoming. Since the extensive bibliographies appearing at the end of each of the three chapters are of some redeeming value and serve a valuable purpose in supplying voluminous reference material for researchers, the book can be recommended for use in medical libraries.

LT. COL. EARL S. HALLINGER, JR., MC, USA

BIOCHEMISTRY OF BLOOD IN HEALTH AND DISEASE, by *I. Newton Kugelmass*, M.D., Ph.D., Sc.D. 643 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $15.75.

The interdependence of the fields of medicine and biochemistry becomes increasingly apparent in this monograph, devoted exclusively to the changes in composition of blood as it varies from time to time and place to place in the body. The author treats the role of the blood in 3 parts. The first part reveals its role as a transport system, interpreted for proteins, nitrogenous compounds, carbohydrates, and lipids. Part 2 discusses the role of blood as a regulatory system, interpreted for water and electrolytes, mineral elements, vitamins, enzymes, and hormones. The final part portrays the role of blood as a defense system, interpreted in terms of clotting mechanisms, hemoglobin for ensuring tissue respiration, and immune bodies. This last part gives excellent coverage of the numerous blood-grouping substances, leukemias, anemias, hemoglobinopathies, polycythemias, and clotting disorders. Each part is generously furnished with tables, metabolic pathway schema, graphs, and illustrations, presenting the essential material concisely. Such a book could profitably be put before biochemists to help them understand the needs of present-day physicians as well as provide a ready reference to the busy practitioner. One of the book's greatest advantages is that it affords the reader access, in condensed, time-saving form, to recent advances, which have been correlated with the older knowledge. The author is a consultant to the Department of Health and Hospitals, New York City, as well as an eminent pediatrician.

MAJ. RICHARD E. KRAUSE, USAF, MSC

A SYNOPSIS OF OBSTETRICS AND GYNAECOLOGY, by *Aleck W. Bourne*, M.A., M.B., B. Ch. (Camb.), F.R.C.S. (Eng.), F.R.C.O.G. 12th edition, revised. 632 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $8.

As emphasized by the author in the preface to the present edition, this small volume is expressly written for the student and busy general practitioner. It is not a reference for the specialist but a source of minutiae and essential data for anyone requiring the bare necessities for arriving at a correct diagnosis and following through with the required treatment of any obstetric or gynecologic condition. The book is well organized and contains the usual outline description of the common obstetric and gynecologic conditions found in much larger textbooks. There is a very good index, and some rather simple pen-and-ink illustrations aid the explanatory passages of the text in several instances. The British approach to many obstetric difficulties is emphasized and is perhaps at variance with American methods of resolving similar problems. Insufficient emphasis is placed on the use of antihypertensive drugs in the treatment of the severe toxemias of pregnancy. However, the new chapter on intersex is interesting and provocative. All in all, this is a volume that would benefit the general practitioner but would contribute very little to the background of the established specialist.

CAPT. WILLIAM S. BAKER, JR., MC, USN

A TEXT-BOOK OF X-RAY DIAGNOSIS, Volume IV, edited by *S. Cochrane Shanks*, C.B.E., M.D., F.R.C.P., F.F.R., and *Peter Kerley*, C.V.O., C.B.E., M.D., F.R.C.P., D.M.R.E., 3d edition. 714 pages; illustrated. W.B. Saunders Co., Philadelphia, Pa., 1959. Price $21.

The preparation of the new edition of this volume dealing with the roentgen features of the bones, joints, and soft tissues in their normal as well as diseased states was prompted by the many advances in this field since the publication of the last edition in 1950. In seeking to cover the fundamental principles in practical roentgen interpretation as related to the day-to-day clinical problems of the average x-ray department, the authors have followed the pattern of the highly regarded, earlier edition. The book is so written that the various normal and abnormal conditions are described in a succinct manner but with reasonable brevity. Where feasible, pertinent radiographic features are listed numerically in an outline form, and the important clinical and pathologic characteristics are described briefly but adequately to give a clear picture of a given disease. The book is well illustrated. The illustrations, although negatives of roentgenograms as in the past, show the intended roentgen appearances to good advantage. The contents are divided into 11 parts dealing with normal bones and joints, general pathology, congenital deformities, traumatic lesions, inflammatory diseases, osteochondritis, static lesions, intervertebral discs, orthopedic operations, constitutional diseases, tumors and cysts, soft tissues, and localization of foreign bodies. Most of the text has been extensively rewritten, with the addition of considerable new material to some of the subjects previously described in less detail, such as myositis ossificans, aseptic necrosis, metaphyseal injuries of childhood, Charcot's joint, and fibroma of bone. Among the new subjects not covered in the earlier edition are diastematomyelia, chondromalacia patellae, periosteal new bone formation in infants, infantile cortical hyperostosis, chondroblastoma, aneurysmal bone cyst, hypophosphatasia, and loaiasis. It is anticipated that this volume will continue to enjoy the popularity of its predecessor. The authors have succeeded in preparing a book designed to reflect the best current practice of radiology.

COL. HARRY L. BERMAN, MC, USA

New Books

Books received by the U.S. ARMED FORCES MEDICAL JOURNAL *are listed in this department for the information of readers, and as acknowledgement and appreciation of their receipt from the publishers. Those of greatest interest will be selected for review in a subsequent number of the* JOURNAL.

NIGHT VISION, by *Gaeten E. Jayle; Albert G. Ourgaud; L. F. Baisinger*, M.D., and *William John Holmes*, M.D., with an introduction by Sir *Stewart Duke-Elder*. 408 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $13.50.

THE PHARMACOLOGY AND CLINICAL USE OF DIURETICS, by *Carroll A. Handley*, Ph. D., and *John H. Moyer*, M.D. 194 pages. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $6.

THE LAW OF MEDICAL PRACTICE, by *Burke Shartel* and *Marcus L. Plant*. 445 pages. Charles C Thomas, Publisher, Springfield, Ill., 1959. Price $12.50.

CLINICAL AUSCULTATION OF THE HEART, by *Samuel A. Levine*, M.D., Sc. D. (Hon), and *W. Proctor Harvey*, M.D. 2d edition. 657 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $11.

ESSENTIALS OF REMOVABLE PARTIAL DENTURE PROSTHESIS, by *Oliver C. Applegate*, D.D.S., D.D. Sc., F.A.C.D. 2d edition. 364 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $14.

MEDICAL MANAGEMENT OF THE MENOPAUSE, by *Minnie B. Goldberg*, M.D. 98 pages; illustrated. Grune & Stratton, Inc., New York, N.Y., 1959. Price $4.50.

DISORDERS OF THE TEMPOROMANDIBULAR JOINT, Diagnosis, Management, Relation to Occlusion of Teeth, by *Laszlo Schwartz*, D.D.S., and 18 contributors. 471 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1959. Price $15.

A SYNOPSIS OF OBSTETRICS AND GYNAECOLOGY, by *Aleck W. Bourne*, M.A., M.B., B. Ch. (Camb.), F.R.C.S. (Eng.), F.R.C.O.G. 12th edition, revised. 632 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $8.

SPACE TECHNOLOGY, edited by *Howard S. Seifert*, with 38 contributors. 975 pages; illustrated. John Wiley & Sons, Inc., New York, N.Y., 1959. Price $22.50.

THE PHYSIOLOGY AND TREATMENT OF PEPTIC ULCER, edited by *J. Farrott Allen*, with 11 contributors. 236 pages; illustrated. University of Chicago Press, Chicago, Ill., 1959. Price $7.50.

FREUDIANISM AND THE LITERARY MIND, by *Frederick J. Hoffman*. 350 pages. Grove Press, Inc., New York, N.Y., 1959. Price $2.45.

THE ARTERIAL WALL, edited by *Albert I. Lansing*, A.B., Ph. D. Sponsored by the *Gerontological Society, Inc.* 259 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $7.50.

EXPERIMENTAL SURGERY, Including Surgical Physiology, by *J. Markowitz*, M.B.E., M.D. (Tor.), Ph. D., M.S. in Exp. Surg. (Minn.), *J. Archibald*, D.V.M., M.V. Sc., Dr. Med. Vet. (Giessen), M.R.C.V.S., *H. G. Downie*, D.V.M., M.S. (Cornell) M.V. Sc. 4th edition. 931 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1959. Price $12.50.

Correspondence

The Lilly Research Laboratories
Indianapolis, Indiana

Just a note to congratulate you on the fine anniversary number of *our* Journal. You certainly had an all-star array of well-wishers.

S. O. Waife, M.D.,
Medical Division

A.M.A. Archives of Surgery
Rochester, Minnesota

Heartiest congratulations on the tenth anniversary number of the Armed Forces Medical Journal. All of the papers were excellent. I enjoyed, too, reading the news from the different departments and seeing photographs of the different Armed Forces hospitals. I join with the many scientists, editors, and friends who wrote you such interesting letters of greetings and congratulations. I am sure your journal will continue to have a very important influence not only in military medicine, but in helping to coordinate the activities of the Armed Forces medical officers with the work of their opposite number in civilian medicine and surgery. With sincere good wishes for a continuation of the fine contributions made to medicine, surgery, and their specialties by the *United States Armed Forces Medical Journal.*

Waltman Walters, M.D.

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